HP 8445B

Ser: 1351A

OPERATING AND SERVICE MANUAL

AUTOMATIC PRESELECTOR

8445B

PRELIMINARY MANUAL

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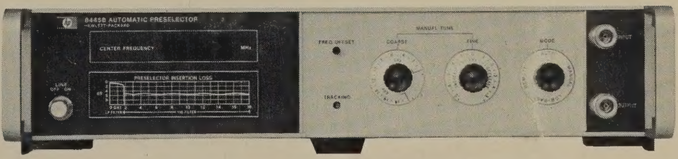

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8445B

AUTOMATIC PRE-SELECTOR

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PRELIMINARY OPERATING AND SERVICE MANUAL

8445B
AUTOMATIC PRESELECTOR

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 1251A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

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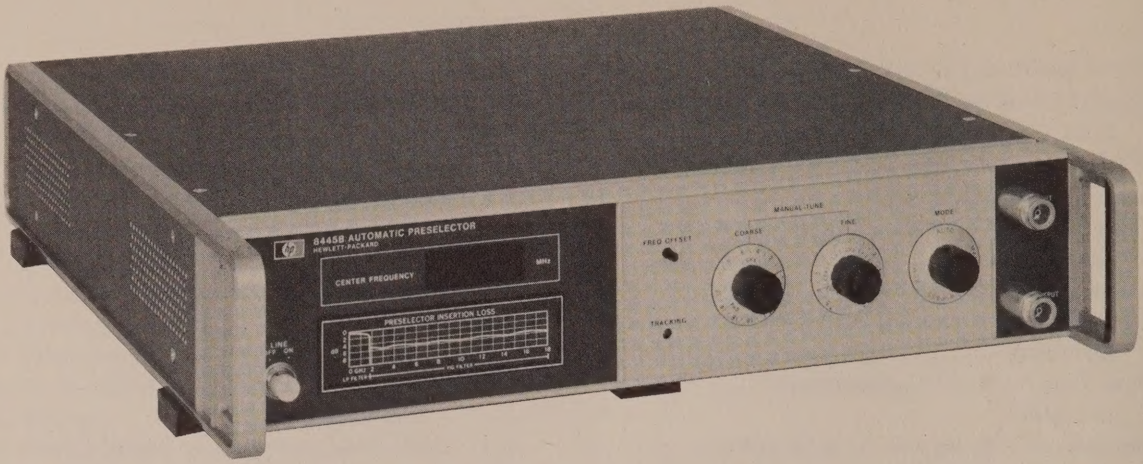
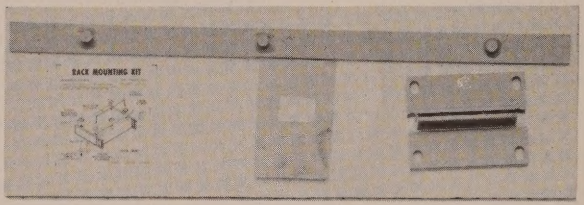
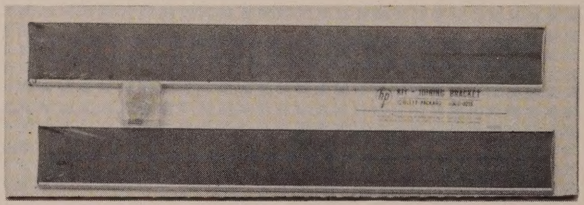


MODEL 8445B (OPTION 002/003)



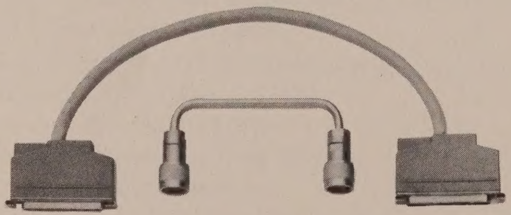
RACK MOUNTING KIT



JOINING BRACKET KIT

FUSE

INTERCONNECT CABLE



RF INTERCONNECT CABLE

LINE POWER CABLE

NOTE: See ACCESSORIES SUPPLIED in Section I for part number information.

Figure 1-1. Model 8445B and Accessories Supplied

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test, adjust and service the Hewlett-Packard Model 8445B Automatic Preselector. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the Hewlett-Packard Model 8445B Automatic Preselector with accessories supplied.

1-4. The various sections in this manual provide information as follows:

SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.

SECTION III, OPERATION, provides information relative to operating the instrument.

SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specifications.

SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

SECTION VI, REPLACEABLE PARTS, provides ordering information for all replaceable parts and assemblies.

SECTION VII, MANUAL CHANGES, normally will contain no relevant information in the original issue of a manual. This section is reserved to provide back-dated and up-dated information in manual revisions or reprints.

SECTION VIII, SERVICE, includes all information required to service the instrument.

1-5. Packaged with this manual is an Operating Information Supplement. This is simply a copy of the first three sections of this manual. This supplement should stay with the instrument for use by the operator. Additional copies of *both* the Operating Information supplement may be ordered separately through your nearest Hewlett-Packard office. The part number is listed on the title page of this manual.

1-6. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4 x 6-inch microfilm transparencies of the manual. Each microfiche contains up to 60 photo-duplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-7. Instrument specifications are listed in Table 1-1. These specifications are the performance standards, or limits against which the instrument may be tested.

1-8. INSTRUMENTS COVERED BY MANUAL

1-9. Including Option 003 Instruments

1-10. This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form the sequential suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

1-11. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a yellow Manual Changes supplement that contains "change information" that documents the differences.

1-12. In addition to change information, the Manual Change supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

1-13. For information concerning a serial number prefix not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

Table 1-1. 8445B Specifications

SPECIFICATIONS

Frequency Range: DC— 1.8 GHz Low-Pass Filter.
1.8 — 18 GHz Tracking Filter.

Digital Frequency Readout (Option 003):
Resolution: 1 MHz.
Accuracy: 0.01—1.8 GHz ±6 MHz
1.8—18 GHz ±0.2%.

Tracking Filter 3 dB Bandwidth: Typically 20—45 MHz.

Tracking Filter Skirt Roll-off: Characteristics of a three-pole filter.

Insertion Loss:

	Frequency	Insertion Loss (except Opt. 004)	Insertion Loss (Opt. 004)
Low-pass Filter	DC—1.8 GHz @ 2.05 GHz	<2.5 dB >50 dB	*
Tracking Filter	1.8—12 GHz 12—18 GHz	<8 dB <10 dB	<7 dB <8 dB

*Low-Pass Filter deleted with Option 004.

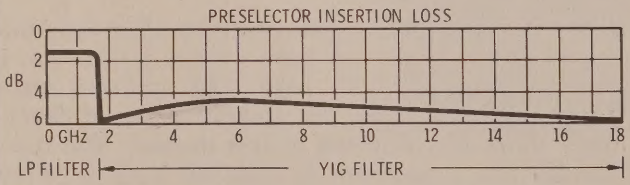


Figure 1-2. Typical Preselector Minimum Insertion Loss @ 25° C

Input VSWR: Typically <2.0 (1.8—18 GHz).

Out-of-Band Rejection: For YIG filter 1 GHz from center of passband >70 dB.

8555A Local Oscillator Emission with Preselector: Typically <—70 dBm over recommended operating ranges with Spectrum Analyzer input attenuator set to 0 dB. (See Table 3-1, Recommended Frequency Ranges and Mixing Modes.)

Limiting Level: >+5 dBm for <1 dB signal compression.

Burnout Level: >+20 dBm.

Remote Function: YIG filter frequency can be set by externally supplied voltage. Differential input utilized to eliminate AC hum or other common mode signals which may be present on remote drive input cable.

Sensitivity: Nominally +1 volt/GHz (with direction of tuning from low to high frequency).

Differential Input Resistance: 2K ohms.

Common Mode Rejection Ratio: 80 dB.

Settling Time: Typically within 3 MHz of final frequency after 5 ms.

Hysteresis: <25 MHz.

Tuning Linearity: <±10 MHz.

Remote Input Connector: BNC female, outer conductor isolated.

1-14. Option 003 Instruments Only

1-15. When an 8445B, Option 003 instrument is ordered, this manual, the Option 003 supplement, and the A7 Digital Panel Meter (HP Model 34740A) manual are included in a binder.

1-16. This manual provides necessary references to either the supplement or the A7 DPM Assembly (34740A) manual. The supplement includes partial schematics, tables, and explanations of interconnections and/or modifications made to the Digital Panel Meter which make it compatible to the 8445B.

1-17. DESCRIPTION

1-18. The Model 8445B Automatic Preselector is designed to complement the Model 8555A Spectrum Analyzer RF Section. The Preselector covers the frequency range of 0 to 18 GHz. When used with the 8555A Spectrum Analyzer, the Preselector functions to reduce or eliminate signal intermodulation, and multiple and spurious responses. The Preselector is a fixed frequency lowpass filter over the 0 to 1.8 GHz frequency range and a voltage tuned filter, using a YIG (yttrium-iron-garnet) crystal as a resonant tuning circuit in the RF signal path, over the frequency range of 1.8 to

18 GHz. When used with the 8555A Spectrum Analyzer, the YIG filter is a swept selective filter that tracks the frequency of the analyzer's response as the analyzer sweeps across its selected range. The YIG filter is electronically tuned by sweep voltage and band code signals from the analyzer. In addition to its primary function as a Preselector, the YIG filter may be used as a manually or electronically tuned bandpass filter. The YIG filter may be tuned by external sweep voltage or manually tuned by front panel controls. A Digital Panel Meter (Option 003) normally indicates the Spectrum Analyzer center frequency. In remote or manual modes, the indicated frequency is that to which the YIG filter is tuned.

1-19. OPTIONS

1-20. The standard 8445B Automatic Preselector contains a 1.8 GHz low-pass filter, a YIG filter, and Type N RF filter ports.

1-21. Option 001. The Type N filter ports are replaced by Precision APC-7 connectors.

1-22. Option 002. Front panel MODE and MANUAL TUNE controls are added to the Automatic Preselector for manual operation.

1-23. Option 003. Digital readout of the spectrum analyzer center frequency is displayed on the front panel.

1-24. Option 004. The 1.8 GHz low-pass filter is deleted.

1-25. Option 005. The semi-rigid coaxial cable, HP 11670L, normally included as an accessory, is deleted.

1-26. ACCESSORIES SUPPLIED

1-27. Table 1-2 lists the accessories supplied with the Preselector. The accessories supplied are for a standard installation which provides for the Preselector to be mounted on and joined with an 8555A Spectrum Analyzer. This configuration allows the instruments to be either bench or rack mounted. A different mounting installation will require a different RF cable to connect between the Preselector output and the Spectrum Analyzer input. The power cable supplied with the instrument is selected at time of shipment. Selection is based on shipping destination. Figure 2-2 illustrates the different power cable connectors that are currently available.

1-28. EQUIPMENT REQUIRED BUT NOT SUPPLIED

1-29. The Automatic Preselector is intended for use with the 8555A Spectrum Analyzer System. This includes an 8555A RF Section, an 8552 series IF Section, and a 140 or 141 series Display Section.

1-30. EQUIPMENT AVAILABLE

1-31. RF Interconnect cables for use with the Preselector are shown in Figure 1-3 and listed in Table 1-3.

Table 1-2. Accessories Supplied

HP Part Number	Name	Description
*	Line Power Cable	7-1/2 feet, 3-wire AC Line Cord
11670L**	RF Interconnect Cable	Rigid Coaxial Cable. Connects Preselector RF output to Spectrum Analyzer RF Input. Type N connectors.
08445-60007	Interconnect Cable	20-inch Control Cable, interconnects Preselector with Spectrum Analyzer.
2110-0012	Fuse	0.5A — 220/240 Vac
5060-8739	Rack Mounting Kit	Hardware and parts for mounting Preselector in 19-inch rack.
5060-8543	Joining Bracket Kit	Hardware and parts for strapping Preselector to Spectrum Analyzer.

*See paragraph 2-10 and Figure 2-2.
**See paragraph 1-27 and Figure 1-3; item not supplied with Option 005.

1-32. WARRANTY

1-33. The 8445B Automatic Preselector is warranted and certified as indicated on the inner front cover of this manual. For further information, contact the nearest Hewlett-Packard office; addresses are provided on the last page and rear cover of this manual.

1-34. RECOMMENDED TEST EQUIPMENT

1-35. Table 1-4 lists the test equipment and accessories required to check, adjust and repair the Preselector. If substitute equipment is used it must meet the Minimum Specifications listed in Table 1-4.

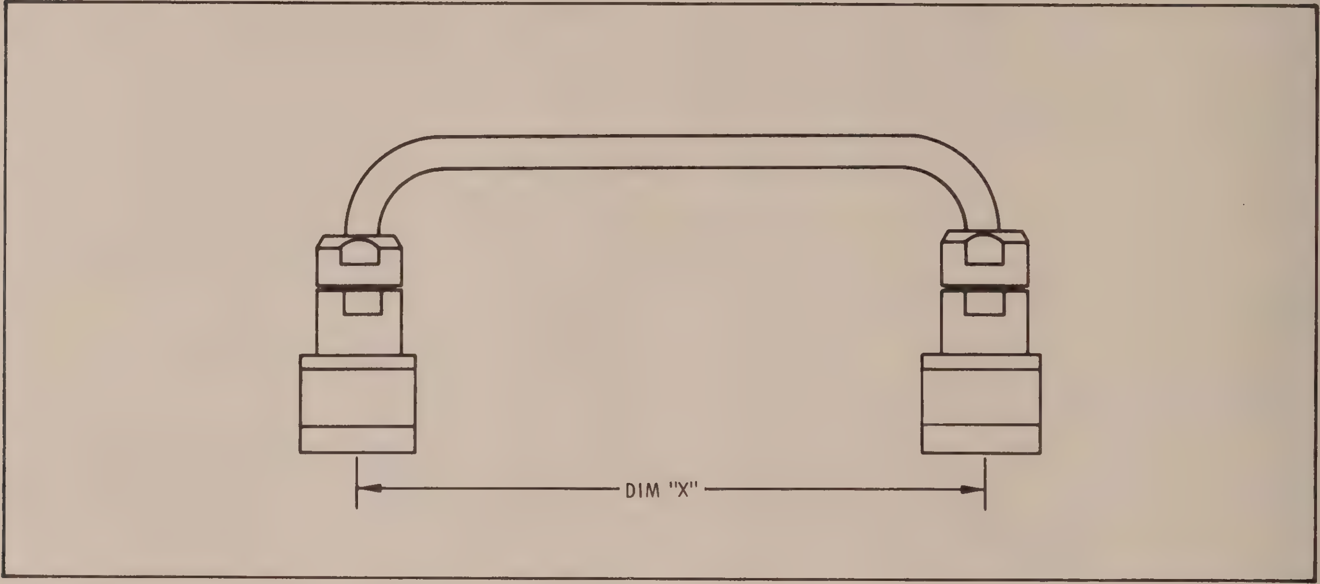


Figure 1-3. RF Interconnect Cable

Table 1-3. RF Interconnect Cables

Part No.	Connector Type	Mounting Configuration	Dim. "X" (Inches)
11670C	Type N	Preselector above Spectrum Analyzer	4.720
11670D	APC-7	Preselector above Spectrum Analyzer	4.720
11670G	Type N	Preselector above Spectrum Analyzer — Rack mounted	4.580
11670H	APC-7	Preselector above Spectrum Analyzer — Rack mounted	4.580
11670L*	Type N	Preselector above Spectrum Analyzer — Joining Bracket Kit	4.360
11670M**	APC-7	Preselector above Spectrum Analyzer — Joining Bracket Kit	4.360

*Cable normally supplied - delete with Option 005 instruments.
**Cable supplied with Option 001 instruments.

Table 1-4. Test Equipment and Accessories (1 of 2)

Item	Minimum Specifications	Suggested Model	Use*
Frequency Comb Generator	Frequency markers spaced 1, 10, 100 MHz apart; usable to 8 GHz Frequency Accuracy: ±0.01% Output Amplitude: >— 40 dBm to 2 GHz	HP 8406A Comb Generator	A, T
Signal Generator	Frequency Range: 1.8 — 4.0 GHz Frequency Accuracy: ±1% Output Amplitude: > +5 dBm Output Impedance: 50 ohms	HP 8616A/B Signal Generator	P, A
Sweep Oscillator	Frequency Range: 2.0 — 18 GHz Output Amplitude: >—5 dBm Output Impedance: 50 ohms	HP 8690B Sweep Oscillator with 8692B RF Unit 8693B RF Unit 8694B RF Unit 8695A RF Unit	P, A
Digital Voltmeter	Voltage Accuracy: ±0.01% of reading +0.01% of range Resolution: ±1 mV @ 10 volts Overrange: 50% Input Impedance: 10 megohms Polarity: Automatic Indication	HP 3480B Digital Multimeter with HP 3484A Multi-Function Unit	A, T
Oscilloscope	Frequency Range: dc to 50 MHz Time Base: 1 μs/div to 10 ms/div Time Base Accuracy: ±3% Dual Channel, Alternate Operation AC or dc Coupling External Sweep Mode Voltage Accuracy: ±3% Sensitivity: 0.005 V/div	HP 180A with HP 1801A Vertical Amplifier and HP 1821A Horizontal Amplifier HP 10004 10:1 Divider Probes (2)	T
Power Meter	Frequency Range: 0.01—18.0 GHz Accuracy: ±1% Power Range: —20 to +10 dBm	HP 432A Power Meter with HP 8478B Thermistor Mount	P
Power Supply Dual DC	Output Voltage: Variable, 0 — 20 Vdc Output Current: 0—300 mA Meter Accuracy: 3% Control: Fine adjustment	HP 6205B Power Supply	P, A, T
DC Volt-Ohm-Ammeter	Voltmeter Voltage Range: 1 mV — 300 V Accuracy: ±1% Input Resistance: 10 megohms Ammeter Current Range: 1 μA — 1A Accuracy: ±2% Ohmmeter Resistance range: 1 ohm — 100 megohm Accuracy: ±5% reading at center scale	HP 412A Volt Ohm-Ammeter	T

*A = Adjustments; T = Troubleshooting; P = Performance

Table 1-4. Test Equipment and Accessories (2 of 2)

Item	Minimum Specifications	Suggested Model	Use*
Spectrum Analyzer	Frequency Range: 0.01 — 18 GHz Frequency Response: < ± 2.0 dB	HP 8555A Spectrum Analyzer with HP 8552 IF Section and HP 141T Display Section	P, A, T
AC Voltmeter	Voltage Accuracy: ±3% of full scale Voltage Range: 300 V full scale Input Impedance: 10 megohms	HP 410C Multifunction Voltmeter	A
Variable Voltage Transformer	Voltage Range: 102 — 127 Vac	General Radio W5MT3A or Superior Electric UC1M	A
Coaxial Cable	Male BNC Connectors, 44 inches long with alligator clips	HP 10501A Cable Assy w/alligator clips	P, A
Frequency Meter	Frequency Range: 2 — 18 GHz Overall Accuracy: 0.2%	HP 536A/537A/P532A Frequency Meters	A
Swept Frequency Indicator	Sensitivity: 5 dB/div Blanking: 0 — 5 V gate Vertical Input Impedance: 75K ohms	HP 1416A Swept Frequency Indicator	A
Directional Coupler (2 each)	Frequency Range: Usable from 2 — 18 GHz	HP 779D Directional Coupler	A
10 dB Coaxial Attenuator	Frequency Range: DC — 18 GHz	HP 8491B Coaxial Attenuator , Option 010	A
Crystal Detector	Frequency Range: 1.8 — 18 GHz	HP 8470A Crystal Detector	A
Crystal Detector	Frequency Range: Usable to 18 GHz	HP 423A Crystal Detector	A
Adapter	APC-7 to Type N male	HP 11525A	A

*A = Adjustments; T = Troubleshooting; P = Performance

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section includes information on the initial inspection, preparation for use, and storage/shipment instructions for the HP Model 8445B.

2-3. INITIAL INSPECTION

2-4. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically. The contents of the shipment should be as shown in Figure 1-1, and procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for carrier's inspection. The HP office will arrange for repair or replacement without waiting for claim settlement.

2-5. PREPARATION FOR USE

2-6. Power Requirements

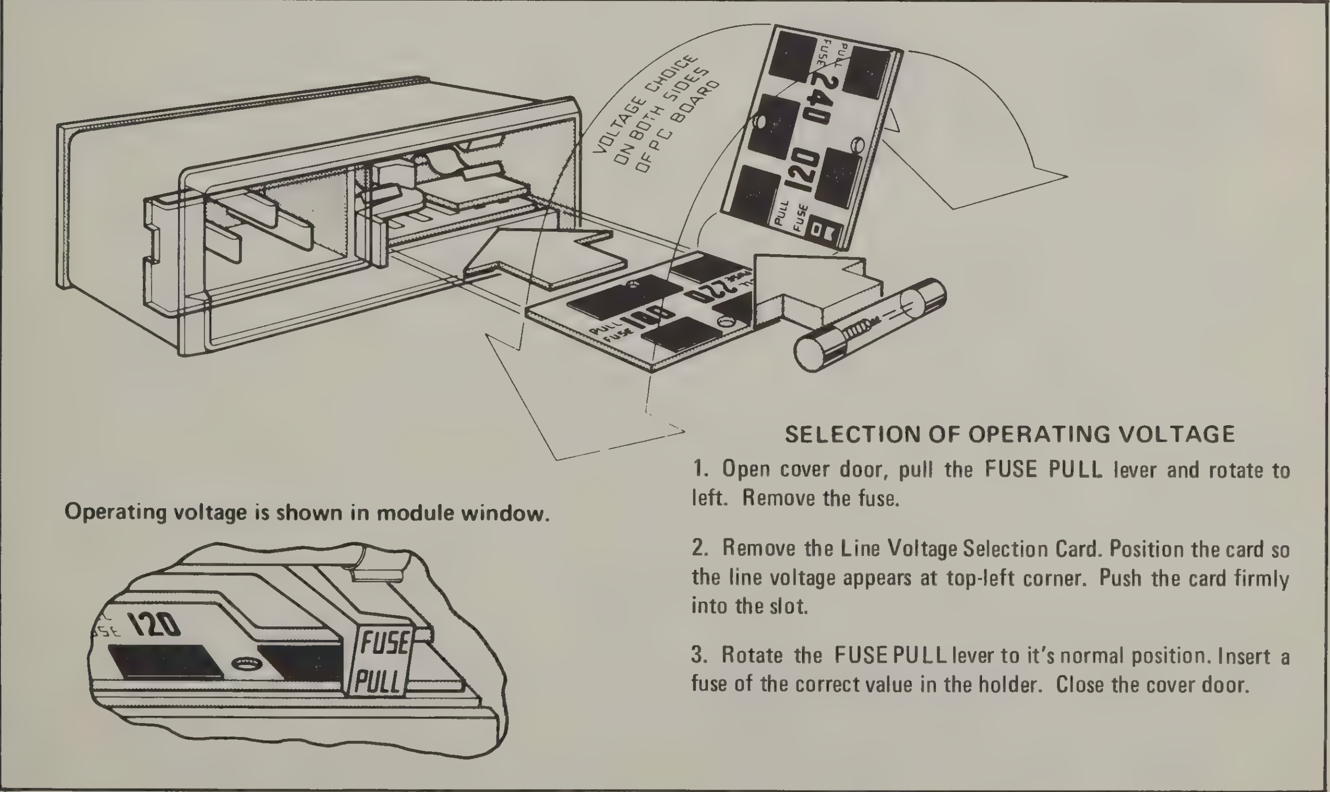
2-7. The 8445B requires a power source of 100, 120, 220, or 240 Vac +5%–10%, 48 to 440 Hz single phase. Power consumption is less than 110 volt-amperes.

2-8. Line Voltage Selection

2-9. Figure 2-1 provides instructions for line voltage and fuse selection. A set of fuses is supplied with the instrument. See ACCESSORIES SUPPLIED in Section I.

CAUTION

To prevent damage to the instrument, make the line voltage selection before connecting line-power.



Operating voltage is shown in module window.

SELECTION OF OPERATING VOLTAGE

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.

2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left corner. Push the card firmly into the slot.

3. Rotate the FUSE PULL lever to it's normal position. Insert a fuse of the correct value in the holder. Close the cover door.

Figure 2-1. Line Voltage Selection

2-10. Power Cable

2-11. In accordance with international safety standards this instrument is equipped with a three-wire power cable. When connected to an appropriate power line outlet, this cable grounds the instrument cabinet. Figure 2-2 shows the styles of mains plugs available on power cables supplied with HP instruments. The numbers under the plug silhouettes are part numbers for complete power cables.

WARNING

The protection provided by grounding the instrument cabinet may be lost if any power cable other than the 3-pronged type is used to couple the ac line voltage to the instrument.

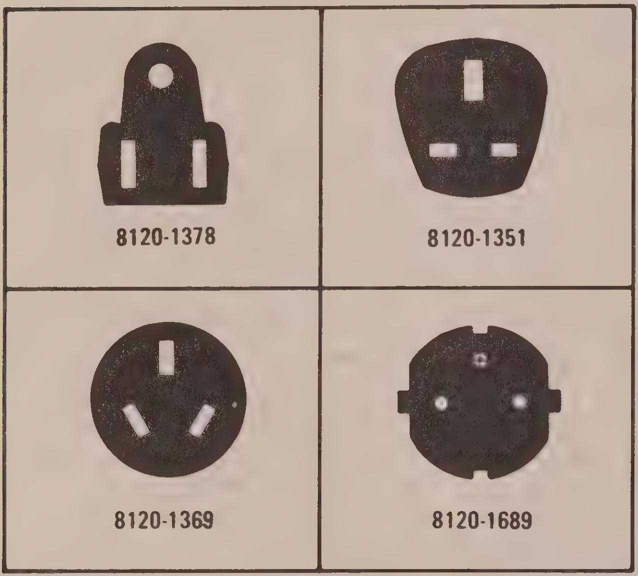


Figure 2-2. Power Cable HP Part Numbers Versus Mains Plugs Available

2-12. Operating Environment

2-13. The operating environment should be within the following limitations:

Temperature .... 0 to 55°C
Humidity .... <95% relative
Altitude .... <15,000 feet

2-14. A forced-air cooling system is used to maintain required operating temperatures within the instrument. The air intake and filter are located on the rear of the instrument; warm air is exhausted through the side panel perforations. When operating the instrument, choose a location which provides at least three inches of clearance around the rear and sides.

2-15. Installation Instructions

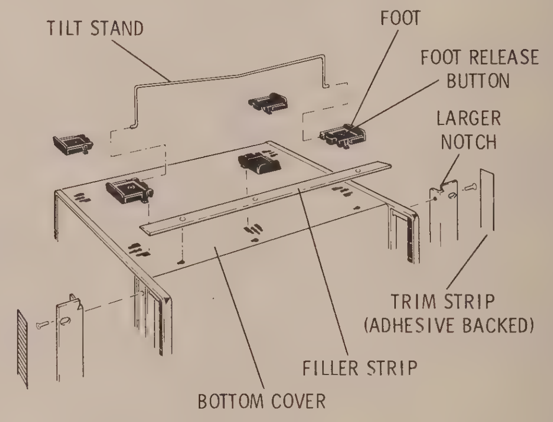
2-16. When used with the Spectrum Analyzer, the Preselector should be both mechanically and electrically connected to the Spectrum Analyzer. The preferred mounting configuration is with the Preselector mounted on top of and secured to the Spectrum Analyzer. A joining bracket kit is supplied to secure the Preselector to the analyzer. A rigid coaxial cable (for the preferred mounting configuration) is supplied to connect the OUTPUT on the Preselector to the INPUT connector of the Spectrum Analyzer. For mounting installations other than the preferred configuration refer to Table 1-3 for cable information.

2-17. Bench Operation

2-18. The instrument cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand raises the front of the instrument for easier viewing of the control panel, and the plastic feet are shaped to make full-width modular instruments self-aligning when stacked.

2-19. Rack Mounting

2-20. This instrument is supplied with a rack mounting kit. This rack mounting kit contains all the necessary hardware and installation instructions for preparing the instrument to be mounted on a rack of 19-inch spacing. The same installation instructions are given in Figure 2-3.



INSTRUCTIONS

1. REMOVE TILT STAND, PLASTIC FEET AND TRIM STRIPS.
2. ATTACH FILLER STRIP AND RACK MOUNTING FLANGES, KEEPING LARGE NOTCH ON FLANGES TO INSTRUMENT BOTTOM.

Figure 2-3. Preparation for Rack Mounting

2-21. MODIFICATIONS REQUIRED

2-22. Display Sections

2-23. HP Model 140T Display Sections (serial prefix 1105A and below), HP Model 141T Display Sections, (serial prefix 1047A and below), all HP Model 140S/141S Display Sections and all HP Model 140-series Oscilloscope Mainframes require modification for Preselector compatibility. (Refer to Table 2-1.) The modification consists of adding a cable assembly to the Display Section. This cable connects between the Auxiliary "B" output connector on the rear panel of the 8555A RF Section and the rear panel of the Display Section.

2-24. 8555A RF Section

2-25. Spectrum Analyzer RF Sections with Serial Prefixes 1232A and below must be modified per Service Note 8555A-1 for compatibility with 8445B Option 003 instruments.

2-26. STORAGE AND SHIPMENT

2-27. Environment

2-28. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

Temperature	—40 to +75°C
Humidity	<95% relative
Altitude	<25,000 feet

2-29. Packaging

2-30. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and full serial number. Also, mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

2-31. Other Packaging. The following general instructions should be used for repackaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard office or service center, attach a tag indicating the type of service required, return address, model number, and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350-pound test material is adequate.

c. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

Table 2-1. Modification of Display Sections for Preselector Compatibility

Modification Kit HP Part Number	DISPLAY SECTION	
	HP Model Number	Serial Prefix
00140-69505	140T	1105A and below
	141T	1047A and below
	140S/141S (Option TG-1)	All
00140-69504	140S/141S (Except Option TG-1 Instruments)	All

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides complete operating instructions for the HP 8445B Automatic Preselector. Front and rear panel controls, connectors and indicators are identified and described in Figures 3-1 and 3-2. Operational adjustments are detailed in Figures 3-3 and 3-4. Additional operating information is contained in Figures 3-5 through 3-7.

3-3. PANEL FEATURES

3-4. Front and rear panel features of the 8445B Automatic Preselector are described in Figures 3-1 and 3-2. Front and rear panel views of the Preselector connected to the HP 8555A/8552B/141T Spectrum Analyzer are shown in Figures 3-3 and 3-4. For a detailed description of the Spectrum Analyzer controls and indicators refer to the appropriate operating and service manuals for those instruments. Interconnection wiring between the Preselector and the Spectrum Analyzer is contained in Section VIII of this manual.

3-5. OPERATOR'S CHECKS

3-6. Upon receipt of the instrument, or when the Preselector is to be used with a different analyzer, perform the operational adjustment procedures listed in Figure 3-4. This procedure corrects for minor differences between the Preselector and the Spectrum Analyzer.

3-7. OPERATING INSTRUCTIONS

3-8. General operating instructions are contained in Figures 3-3 and 3-4. These instructions will familiarize the operator with basic operating functions of the Preselector in use with the Spectrum Analyzer. Additional operating techniques and information are contained in Figures 3-5 through 3-7.

3-9. SPECTRUM ANALYZER PRESELECTION

3-10. The 8555A Spectrum Analyzer RF Section has a 2.05 to 4.1 GHz local oscillator and a 2050 or 550 MHz first IF. The analyzer responds to signals within the 10 MHz to 18 GHz range when using internal mixing. In some cases the open front end, and harmonic mixing of the analyzer, present problems of signal interpretation. The Preselector is used to eliminate unwanted responses on the CRT display. The Preselector uses a low-pass filter over the frequency range of dc to 1.8 GHz and a YIG filter as a microwave resonator in the RF signal path over the frequency range of 1.8 to 18 GHz. The YIG filter is electronically tuned to track a selected analyzer RF tuning response, virtually eliminating multiple image and spurious responses.

CAUTION

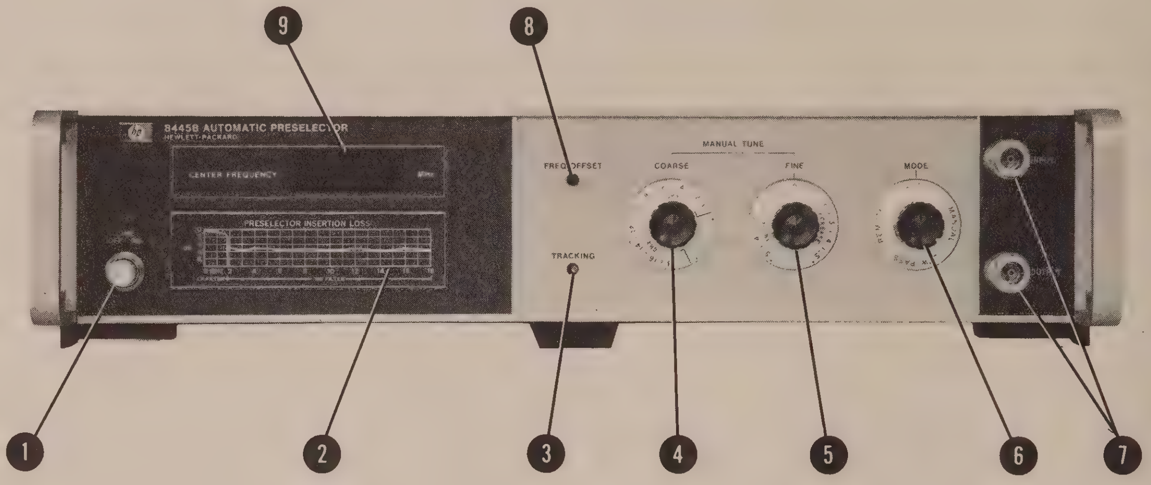
Installation of a coaxial attenuator or a coaxial isolator at the Preselector INPUT is recommended when operating with signal sources that are not capable of absorbing their own reflected power. Signals outside the passband of the Preselector are reflected back to the source.

3-11. Multiple responses occur when the local oscillator harmonics cause more than one display for a single input frequency. For example, when a 9.5 GHz signal is fed to the analyzer RF INPUT, responses due to the 2+, 3—, 4—, and 5— mixing modes appear on the display (see Figure 3-6). Follow the signal frequency line for 9.5 GHz across the figure noting the intersections with solid lines representing mixing modes. The Preselector tracks the selected mixing mode so that responses from other mixing modes are not present on the display.

3-12. When the analyzer local oscillator is tuned to 3 GHz (2050 MHz 1st IF), image responses may occur at different frequencies. (Refer to Figure 3-6.) Follow the 3 GHz local oscillator line up the figure noting the intersections with solid lines representing mixing modes. Each of these signals appear at the same place on the display, and are products of the different mixing modes. The Preselector eliminates images by allowing only selected frequency bands to enter the analyzer's RF INPUT, and allowing only one mixing mode to be used at one time.

3-13. Spurious signal responses are caused when strong signals enter the RF INPUT of the analyzer, and are of sufficient amplitude to cause intermodulation products. The narrow bandwidth of the Preselector tuning response (30 MHz nominal) acts to eliminate spurious signal responses on the display. Signals that are farther apart than the Preselector bandwidth cannot appear in the analyzer input at the same time.

FRONT PANEL FEATURES



❶ **LINE – ON/OFF.** Controls primary power. Light glows when switch is energized. Type A1H bulb.

❷ **PRESELECTOR INSERTION LOSS Chart.** Indicates insertion loss versus frequency. Calibration chart extrapolated from point-to-point measurements of Yig filter insertion loss. FREQ OFFSET control adjusted for minimum insertion loss at each test point. During power level measurement, Spectrum Analyzer LOG REF LEVEL Vernier control may be adjusted to compensate for the indicated insertion loss.

❸ **TRACKING.** Adjusts Yig driver gain to match linear current-frequency curve of Yig filter. Adjusted during operational adjustments at a frequency of 8 GHz. Adjustment required to match tuning of Preselector with tuning of Spectrum Analyzer. Interacts with FREQ OFFSET adjustment. (See Figure 3-4, Operational Adjustments, 1.8 to 18 GHz.)

❹ **MANUAL TUNE COARSE – Option 002 instruments.** Manual Yig filter frequency tune control. Sets Yig filter center frequency in manual operating mode.

❺ **MANUAL TUNE FINE – Option 002 instruments.** Fine tune control for Yig filter frequency in manual operating mode.

❻ **MODE – Option 002 instruments.** Selects Preselector mode of operation. MANUAL — Yig filter tuned by front panel controls. AUTO — Low-pass filter and/or Yig filter selected by control signals from analyzer RF Section. Yig frequency tuned by signal from RF Section. REMOTE — Yig filter tuned by input voltage to BNC connector on rear panel. LOW-PASS (except Option 004) — Selects 1.8 GHz low-pass filter. Inhibits Spectrum Analyzer control of Preselector.

❼ **INPUT.** Type N coaxial connector normally provided. Option 001 instruments supplied with APC-7 connectors.

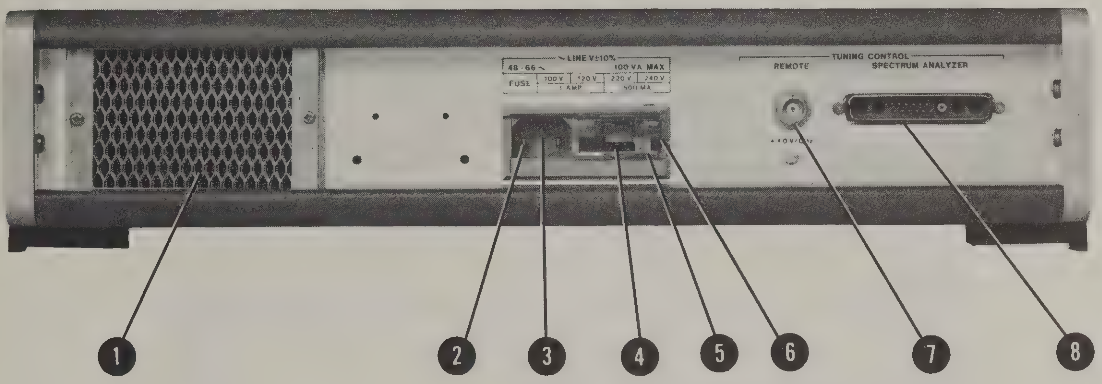
❼ **OUTPUT.** Type N coaxial connector normally provided. Option 001 instruments supplied with APC-7 connector. See Table 1-3 for optional rigid coaxial interconnect cables.

❽ **FREQ OFFSET.** Adjusts Yig driver to compensate for offset in Yig filter tuning due to residual magnetism in core structure. Adjusted to center the Yig filter at 2.0 GHz for wide range tracking. Adjusted for minimum filter insertion loss during power level measurements. (See Figure 3-4, Operational Adjustments, 1.8 to 18 GHz.)

❾ **DIGITAL PANEL METER Frequency Readout — Option 003 Instruments.** Indicates center frequency of the Yig filter passband in Manual or Remote Mode. In Automatic Mode, indicates center frequency of 8555A Spectrum Analyzer, reads zero above 18 GHz or in LOW-PASS Mode.

Figure 3-1. Front Panel Controls, Connectors and Indicators

REAR PANEL FEATURES



① **Air Intake.** Maintain at least 3-inch clearance from surrounding objects.

② **Power Module Assembly.** 100, 120, 220 and 240 Vac +5%, –10%; 48 to 440 Hz 100 VA max.

③ **Line Input.** Connects to external ac power supply.

④ **Line Voltage Selector Card.** Printed circuit board used to match the available line voltage to the transformer primary.

⑤ **Fuse extractor and selector lock.** Prevents line voltage selector card from being removed until fuse is extracted.

⑥ **Line Input Fuse.** Rating of fuse to be used is marked on rear panel near the Power Module Assembly.

⑦ **TUNING CONTROL-REMOTE.** Input for remote tuning voltage to Yig filter. Enabled when Spectrum Analyzer is not operating (power off), when interconnect cable is disconnected or (on Option 002) when the mode switch is set to REMOTE. Type BNC connector. Yig filter frequency to voltage ratio: 1.0 GHz/Volt.

⑧ **TUNING CONTROL – SPECTRUM ANALYZER Input.** Input control voltage (for selection of Yig or low-pass filter), Yig tuning voltage and band code information. Disconnect input cable when using REMOTE input to tune Yig filter.

Figure 3-2. Rear Panel Controls, Connectors and Indicators

OPERATIONAL ADJUSTMENTS

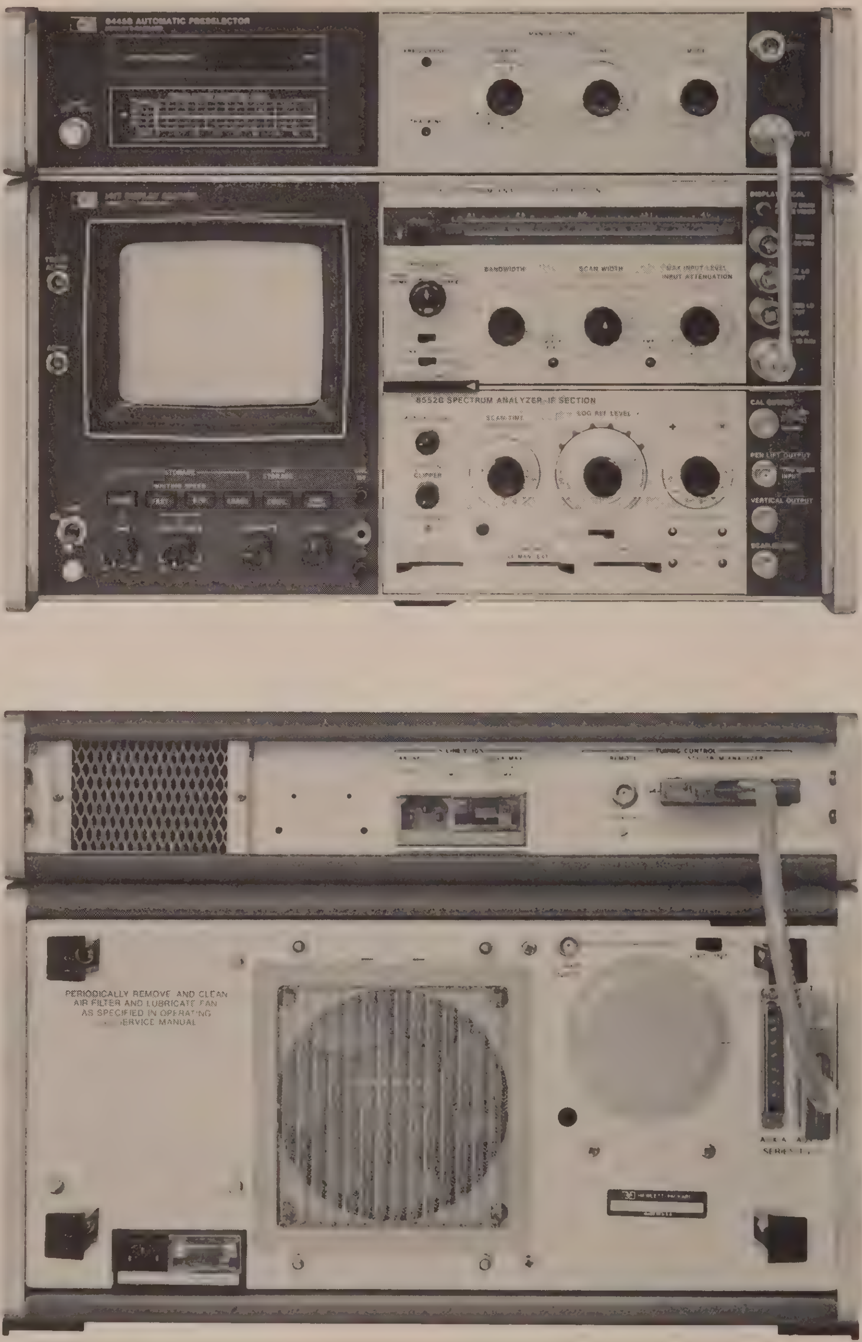


Figure 3-3. Operational Adjustments, Low-Pass Filter Operation, 10 MHz to 1.8 GHz (1 of 2)

OPERATIONAL ADJUSTMENTS

1. Check that the Line Voltage Selection Card is positioned to correspond to the available line voltage. Refer to the information on Line Voltage Selection in Section II.
2. Connect interconnect cable between AUX B output on Spectrum Analyzer Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on Preselector.
3. Connect Preselector and Spectrum Analyzer to line voltage source and apply power.
4. Perform Spectrum Analyzer Operational Adjustments in Section III of Spectrum Analyzer RF Section 8555A Operating and Service Manual.

NOTE

Automatic Preselector Option 004 does not have low-pass filter installed. (Refer to Figure 3-4.)

5. Set analyzer LOG/LINEAR switch to LINEAR and rotate LOG REF LEVEL control until 1 mV/DIV is matched with the lighted index lamp.
6. Connect Analyzer CAL OUTPUT to INPUT of Preselector.
7. Connect rigid coaxial cable between Preselector OUTPUT and Analyzer INPUT.
8. Note and record low-pass filter insertion loss at 30 MHz. From the LIN 7 to 5 line equals approximately 3 dB. Low-pass filter insertion loss should be <1 dB.
9. Remove rigid coaxial cable connecting Preselector OUTPUT to Analyzer INPUT.
10. Set Analyzer INPUT ATTENUATION to 40 dB.
11. Set Analyzer LOG/LINEAR control to LOG.
12. Rotate LOG REF LEVEL control to (+) 10 dBm.
13. Set SCAN WIDTH PER DIVISION to 10 MHz and set FREQUENCY control to position cursor at 1.5 GHz on Frequency Scale.
14. With INPUT ATTENUATION at 40 dB, connect Analyzer SECOND LO OUTPUT to INPUT.
15. Center 1.5 GHz LO signal on CRT display. Reduce SCAN WIDTH PER DIVISION to 0.2 MHz, keeping signal centered on CRT with FREQUENCY control.
16. Rotate LOG REF LEVEL control fully counterclockwise.
17. Set LOG/LINEAR switch to LINEAR and adjust LINEAR SENSITIVITY controls for a 7.1 division display of the 1.5 GHz signal.
18. Disconnect cable at Analyzer INPUT and couple to INPUT connector on Preselector.
19. Connect rigid coaxial cable between Preselector OUTPUT and Analyzer INPUT.
20. Note and record low-pass filter insertion loss at 1.5 GHz. From the LIN 7 to 5 line equals approximately 3 dB. 1.5 GHz low-pass filter insertion loss ⩽ 2.5 dB.
21. Set LOG/LINEAR switch to LOG. Set LOG REF LEVEL Vernier control to compensate for the amount of insertion loss indicated in step 20.
22. The Preselector and Analyzer are now calibrated at 1.5 GHz.
23. Remove cable between Preselector INPUT and Analyzer SECOND LO OUTPUT.
24. Install 50 ohm termination on SECOND LO OUTPUT connector.
25. Connect signal (10 MHz to 1.8 GHz) under investigation to INPUT connector of Preselector.
26. Set LOG REF LEVEL vernier control to compensate for insertion loss using data obtained in steps 8 or 20 above or the data on the PRESELECTOR INSERTION LOSS chart.

Figure 3-3. Operational Adjustments, Low-Pass Filter Operation, 10 MHz to 1.8 GHz (2 of 2)

OPERATIONAL ADJUSTMENTS

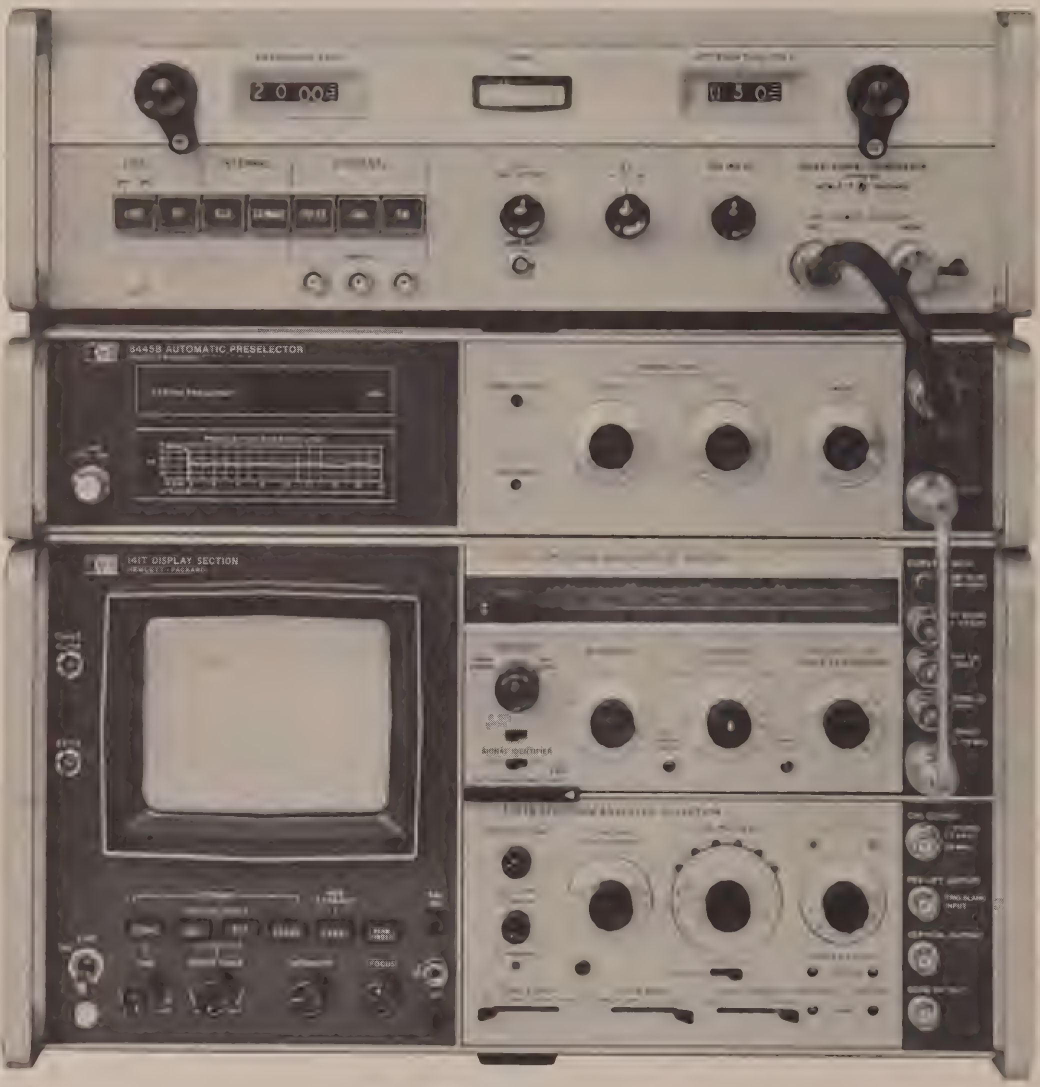


Figure 3-4. Operational Adjustments, 1.8 to 18 GHz (1 of 2)

OPERATIONAL ADJUSTMENTS

1. Check that the Line Voltage Selection Card is positioned to correspond to the available line voltage. Refer to information on Line Voltage Selection in Section II.

2. Connect interconnect cable between AUX B output on Spectrum Analyzer Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on Preselector.

3. Connect Preselector and Spectrum Analyzer to line voltage source and apply power.

4. Perform Spectrum Analyzer Operational Adjustments in Section III of Spectrum Analyzer RF Section 8555A Operating and Service Manual.

5. Connect rigid coaxial cable between Preselector OUTPUT and RF Section INPUT.

6. Set LOG REF LEVEL to 0 dBm.

7. Set SCAN WIDTH PER DIVISION to 10 MHz.

8. Connect a —30 dBm 2.0 GHz signal to INPUT Connector on Preselector.

9. Select n=1—* Frequency BAND and tune Analyzer FREQUENCY control to center the 2.0 GHz signal on CRT display.

10. Reduce SCAN WIDTH PER DIVISION to 0.5 MHz keeping signal centered on display with FREQUENCY control.

11. Reduce SCAN WIDTH PER DIVISION to 100 kHz; center signal on display with FINE TUNE control.

12. Set LOG/LINEAR switch to LINEAR and LINEAR SENSITIVITY control to 1 mV/DIV.

13. Adjust Preselector FREQ OFFSET control to center Yig filter passband on the 2 GHz signal.

14. Set Analyzer LOG/LINEAR control to LOG.

15. Rotate LOG REF LEVEL control to —30 dBm.

16. Adjust LOG REF LEVEL Vernier control to position signal peak on LOG REF LEVEL graticule line.

17. Connect a —30 dBm 8.0 GHz signal to INPUT Connector on Preselector.

18. Select n=2+ Frequency BAND on Analyzer, set SCAN WIDTH PER DIVISION to 10 MHz, and tune FREQUENCY control to center the 8.0 GHz signal on CRT display.

19. Reduce SCAN WIDTH PER DIVISION to 0.5 MHz keeping signal centered on display with FREQUENCY control.

20. Reduce SCAN WIDTH PER DIVISION to 100 kHz; center signal on display with FINE TUNE control.

21. Set LOG/LINEAR switch to LINEAR and LINEAR SENSITIVITY control to 1 mV/DIV.

22. Adjust Preselector TRACKING control to maximize signal on CRT display.

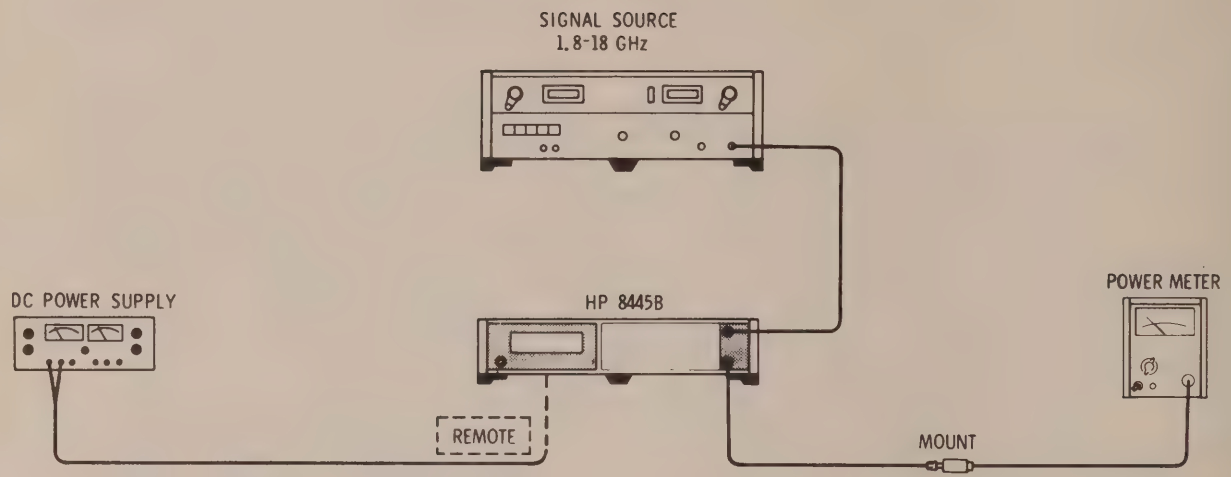
23. If signal is already at maximum, no further adjustment of FREQ OFFSET or TRACKING is required.
24. If signal was not at maximum, repeat steps 7 through 22 until a setting is found which satisfies requirements of steps 13 and 22.

NOTE

Incorrect tracking of preselector to the Spectrum Analyzer may be due to aging or misadjustment of the 8555A Yig Driver Assembly. Follow the directions given in Section V of the 8555A Operating and Service Manual under Yig Driver Adjustments.

Figure 3-4. Operational Adjustments, 1.8 to 18 GHz (2 of 2)

REMOTE OPERATION



1. Check that the Line Voltage Selection Card is positioned to correspond to the available line voltage. Refer to the information on Line Voltage Selection in Section II.
2. For instruments without front panel controls disconnect interconnect cable between AUX B output on Spectrum Analyzer Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on Preselector.
3. For instruments with front panel controls, set MODE switch to REMOTE. Interconnect cable may be installed or removed.
4. Connect Preselector to line voltage source and apply power.
5. Connect a variable 0 to +20 volt dc voltage source through a coaxial cable with a BNC connector to the REMOTE input on the Preselector. Connect the negative side of the power source to the coaxial shield and the positive side to the center conductor.
6. The REMOTE-input voltage-to-frequency ratio of +1 volt/GHz is affected by the position of the FREQ OFFSET and TRACKING controls. For optimum remote operation, perform Yig Driver Adjustments in Section V.
7. Adjust voltage source to tune Yig filter to frequency of interest. The bandpass of the Yig filter (typically 20 to 45 MHz) requires a source with a fine voltage adjustment to center filter bandpass at the frequency of interest.
8. Connect signal source to the INPUT port. The Yig filter OUTPUT may be connected to an analyzer or power meter.
9. Fine tune the input dc voltage source to peak the Yig filter for maximum output.

Figure 3-5. YIG Filter Remote Operation, 1.8 to 18 GHz

3-14. PRESELECTOR BANDWIDTH

3-15. The Yig filter has a 3 dB bandwidth that is typically 20 to 45 MHz. (See Figure 3-7.) For wideband frequency tracking, the FREQ OFFSET control should be adjusted at a frequency of approximately 2 GHz. For narrow band tracking with minimum filter insertion loss, the FREQ OFFSET control should be adjusted at the frequency of interest for maximum output level.

NOTE

> Measurement conditions for Figure 3-7. Analyzer bandwidth 300 kHz, 10 dB log. Preselector fixed-tuned to frequency indicated. Input signal tuned through passband.

3-16. RECOMMENDED FREQUENCY RANGES

3-17. Table 3-1 lists the recommended frequency ranges for operation of the Preselector with the Spectrum Analyzer. Analyzer responses, tracked by the Preselector, overlap at the edges of different frequency bands. Note the intersection of the n=1+ and n=3— responses at 4.1 GHz in Figure 3-6. Signals near the intersection points can appear in the passband of the Preselector from both mixing modes.

3-18. PRESELECTOR TRACKING WITH SPECTRUM ANALYZER

3-19. The Preselector tracking with the Spectrum Analyzer is governed by the linearity of the 8555A's Yig Drive sweep voltage versus the first LO frequency. *The inability of the Preselector to track the Spectrum Analyzer frequency may be due to aging or misadjustment of the 8555A Yig Driver Assembly components.* Perform the 8555A Yig Driver Adjustment procedure which is found in Section V of the 8555A Operating and Service Manual.

3-20. PRESELECTOR TRACKING REMOTE/ MANUAL OPERATION

3-21. Preselector tracking in both REMOTE and MANUAL operating modes is affected by the front panel FREQ OFFSET and TRACKING controls. Adjustment of these controls changes the accuracy of the +1 V/GHz remote tuning and the dial accuracy of the manual controls. To adjust FREQ OFFSET and TRACKING controls for REMOTE or MANUAL operation perform the Yig Driver Adjustments in Section V of this manual.

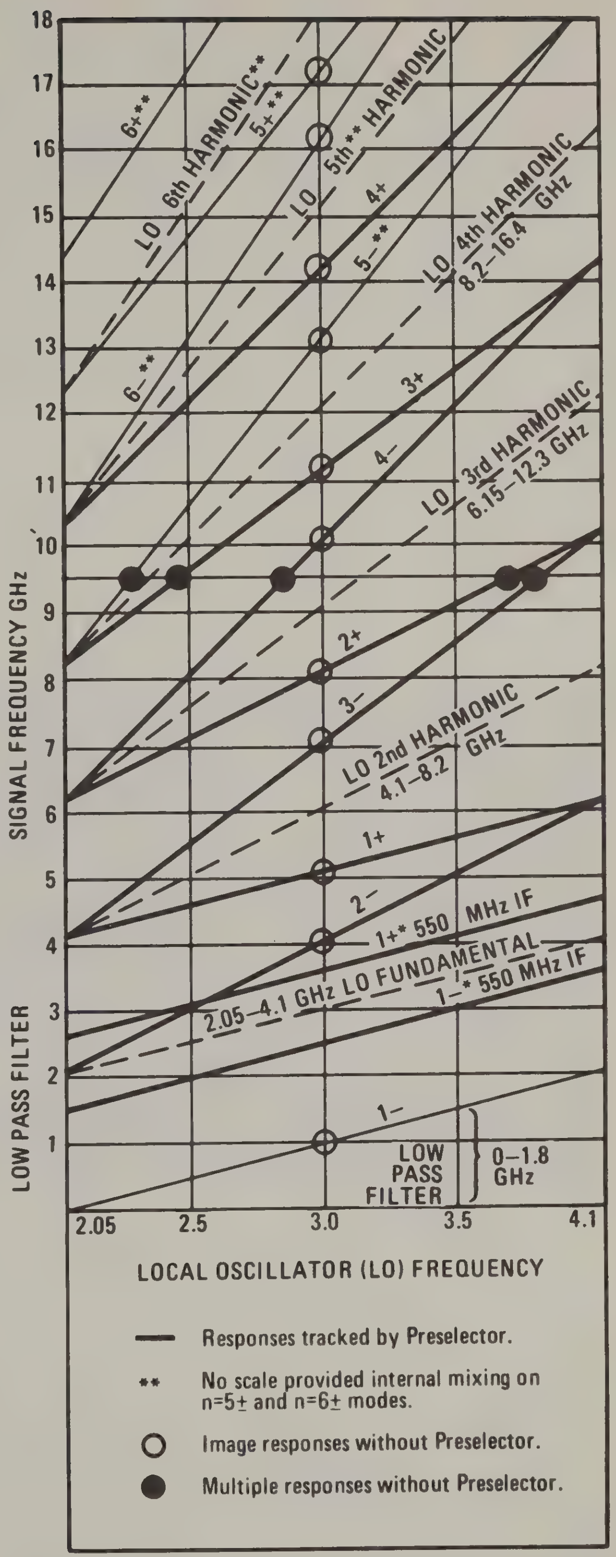


Figure 3-6. Spectrum Analyzer Tuning Curves and Responses

Table 3-1. Recommended Frequency Ranges and Mixing Modes

Signal Frequency GHz	Analyzer Scan Time ≤ 10 ms/DIV		
	Recommended Harmonic	Analyzer Frequency Range GHz	Analyzer IF Frequency MHz
0.01 — 1.8	1–	0.01 — 2.05	2050
1.8 — 3.5	1–*	1.50 — 3.55	550
2.8 — 4.5	1+*	2.60 — 4.65	550
2.8 — 5.5	2–	2.07 — 6.15	2050
4.3 — 5.8	1+	4.11 — 6.15	2050
4.9 — 9.0	3–	4.13 — 10.25	2050
6.6 — 9.5	2+	6.17 — 10.25	2050
7.3 — 13.0	4–	6.19 — 14.35	2050
9.0 — 13.3	3+	8.23 — 14.35	2050
11.0 — 18	4+	10.29 — 18.00	2050

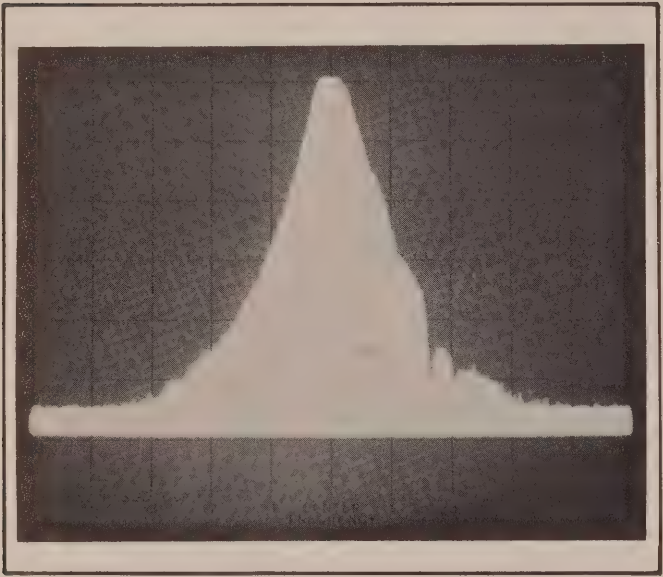


Figure 3-7. Typical Yig Filter Passband at 4 GHz, 10 MHz/DIV Display

NOTE

Adjustment of the 8445B YIG Driver Circuits must be done by following the YIG Driver Adjustment Procedure in Section V.

3-22. OPERATOR'S MAINTENANCE

3-23. Operator's Maintenance involves changing or replacing fuses, cleaning the air filter, and replacing a defective LINE switch lamp. Removing the air filter requires use of a Pozidriv screwdriver; all other operations do not require tools.

3-24. Fuses

3-25. The primary power fuse is found within the A6 assembly on the rear panel of the 8445B. A fuse change may be necessary when the instrument is moved to a location with a different ac line voltage or when the fuse has burned out. Steps one and three of Figure 2-1 show how the fuse is changed or replaced.

3-26. The fuses, F1, may be ordered under HP part numbers 2110-0001, (1/16A, 220—240 Vac), and 2110-0027, (1/8A 100—120 Vac).

3-27. Air Filter

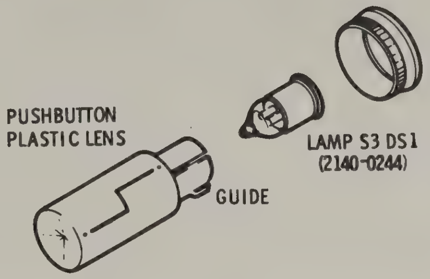
3-28. The air filter should be cleaned periodically. It is recommended that it be checked every three months and, if necessary, washed in warm water and a detergent. After washing allow the filter to dry for a few minutes before reinstallation.

3-29. Fan

3-30. The fan in this instrument is a self-lubricating unit and does not require maintenance.

3-31. Lamp Replacement

3-32. The lamp is contained in the white plastic lens which doubles as a pushbutton for the LINE switch. When the switch is ON, the lamp should be illuminated. Figure 3-8 illustrates how to remove and install the lamp. The lamp, DS1, may be ordered under HP part number 2140-0244.



POWER LAMP REPLACEMENT

1. Remove lens by pulling straight out.
2. Replace lamp.
3. To replace lens, align guide with notch in receptacle. Push straight in.

Figure 3-8. Power Lamp Replacement

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This section contains front panel checks and performance tests for the 8445B Automatic Preselector. Front panel checks for routine inspection are given in paragraph 4-5. Procedures for verifying that the instrument meets specifications are given in paragraphs 4-14 through 4-17. The front-panel checks, preset adjustments and performance test should be performed using the 8555A Spectrum Analyzer System that will normally be used with the Preselector.

4-3. EQUIPMENT REQUIRED

4-4. Test equipment and test accessories for performance (P), adjustment (A), and troubleshooting (T) are listed in Table 1-3. Critical specifications and/or required features for the test equipment and accessories are contained in the test equipment and test accessories table.

4-5. FRONT PANEL CHECKS

4-6. Before proceeding to the performance tests, the instrument must be adjusted and all controls set as specified in the preset adjustment instructions in paragraphs 4-7 and 4-8. After the instrument controls are preset, proceed with the front panel checks and adjustments. The instrument should perform as called out in the preset adjustment procedures before going on to the performance tests (paragraphs 4-14 through 4-17).

4-7. PRESET ADJUSTMENTS

4-8. Install Preselector with Spectrum Analyzer. Ensure that the line voltage selector is set to correspond with the available line voltage (refer to Line Voltage Selection in Section II). Connect interconnect cable between AUX B output on the Display Section and TUNING CONTROL — SPECTRUM ANALYZER input on the Preselector. Connect Preselector and Spectrum Analyzer to line voltage source and apply power. While the instruments are warming up, make the following control settings:

a. PRESELECTOR (with manual controls):

MODE	AUTO

b. SPECTRUM ANALYZER:

BAND	n=1—(2.05 GHz IF)
FREQUENCY	30 MHz
FINE TUNE	Centered
BANDWIDTH	100 kHz
SCAN WIDTH	PER DIVISION
SCAN WIDTH PER DIVISION	10 MHz
INPUT ATTENUATION	10 dB
SIGNAL IDENTIFIER	OFF
BASE LINE CLIPPER	CCW
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG/LINEAR	LOG
LOG REF LEVEL	0 dBm
LOG REF LEVEL Vernier	0
VIDEO FILTER	OFF
SCAN MODE	INT
SCAN TRIGGER	LINE

c. Connect Spectrum Analyzer CAL OUTPUT to its own INPUT.

d. Adjust FREQUENCY to align LO feedthrough signal on the —3 graticule line.

e. Check level of 30 MHz signal at CENTER FREQUENCY line. Signal level should be —30 dBm. Perform AMPL CAL Adjustment if signal level is incorrect. (See 8555A Operating and Service Manual.)

NOTE

Preselectors with Option 004 do not have low-pass filters installed. Disregard steps f, g, h, and i.

f. Connect Spectrum Analyzer CAL OUTPUT to INPUT port on Preselector.

g. Connect OUTPUT port of Preselector to Spectrum Analyzer INPUT.

h. Check level of 30 MHz signal at CENTER FREQUENCY graticule line. There should be little or no change in level of the —30 dBm signal through the low-pass filter in the Preselector.

i. Select BAND n=1+ 550 MHz IF. Note that there is an audible click (from coaxial switches in the Preselector) and the signal disappears from the CRT display.

j. Select BAND n=1— 550 MHz IF.

k. Connect a 2.0 GHz —30 dBm signal to preselector INPUT.

l. Tune Spectrum Analyzer to center 2.0 GHz signal on CRT display.

m. Adjust Preselector FREQ OFFSET to center passband at 2.0 GHz.

n. Select BAND n=2+ and connect a 8.0 GHz, —30 dBm signal to Preselector INPUT.

o. Tune Spectrum Analyzer FREQUENCY control to center signal on CRT display.

p. Adjust Preselector TRACKING control to maximize signal level on CRT display.

q. Repeat steps j through p for optimum adjustment.

4-9. PERFORMANCE TESTS

4-10. The performance tests, given in this section, are suitable for incoming inspection, troubleshooting, or preventive maintenance. During any performance test, all shields and connecting hardware must be in place. The tests are designed to verify published instrument specifications. Perform the tests in the order given, and record data on test card (Table 4-1) and/or in the data spaces provided in each test.

4-11. The tests are arranged in the following order:

Paragraph	Test Description
4-14	Out-of-Band Rejection
4-15	Low-Pass Filter Insertion Loss
4-16	YIG Filter Insertion Loss
4-17	Limiting Level (Signal Compression)

4-12. Each test is arranged so that the specification is written as it appears in Table 1-1, Specifications. Next, a description of the test and any special instructions or problem areas are included. Each test that requires test equipment has a test setup drawing and a list of required equipment. Step 1 of each procedure gives control settings required for that particular test.

4-13. Required minimum specifications for test equipment are detailed in Table 1-4. If substitute test equipment is used, it must meet the specifications listed in order to performance-test the Preselector.

PERFORMANCE TESTS

4-14. OUT-OF-BAND REJECTION TEST

SPECIFICATION: For YIG filter 1 GHz from center of passband >70 dB.

DESCRIPTION: The YIG filter is tuned to a fixed frequency (either manually or remotely). A signal is applied through the filter and the power output level measured. The signal source is then shifted 1 GHz and the power output level is again measured. The difference between the two power levels is the out-of-band rejection for 1 GHz frequency separation.

4-14. OUT-OF-BAND REJECTION TEST (cont'd)

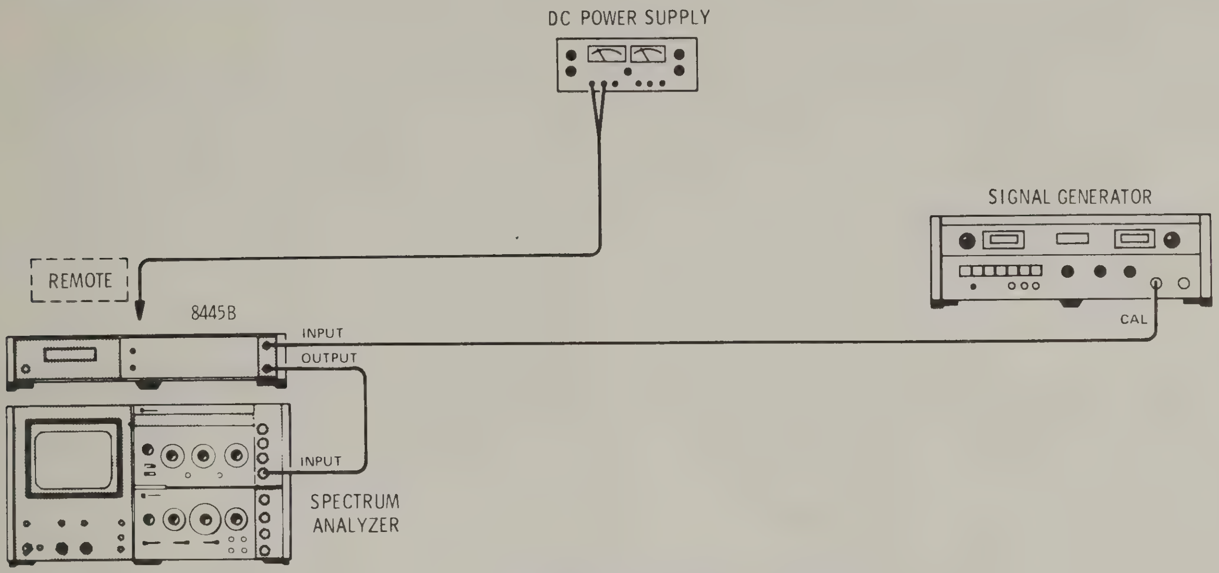


Figure 4-1. Out-of-Band Rejection Test Setup

EQUIPMENT:

Spectrum Analyzer	HP 8555A/8552/141T
Signal Generator	HP 8616B
Power Supply*	HP 6205B
Coaxial Cable (BNC to alligator clips)*	HP 10501A

*Required for Preselectors without manual controls.

1. Connect test setup as indicated in Figure 4-1 and make the following control settings:

PRESELECTOR: (without manual controls)

LINE OFF/ON	ON
Interconnect Cable	Disconnected

PRESELECTOR: (with manual controls)

LINE OFF/ON	ON
MODE	MANUAL
MANUAL TUNE COARSE	3 GHz
MANUAL TUNE FINE	0 GHz

POWER SUPPLY:

Output Voltage	+3 Vdc

ANALYZER:

BAND	n=2—
FREQUENCY	3 GHz
BANDWIDTH	300 kHz
SCAN WIDTH PER DIVISION	10 MHz

4-14. OUT-OF-BAND REJECTION TEST (cont'd)

INPUT ATTENUATION	10 dB
BASE LINE CLIPPER	12 o'clock
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG REF LEVEL	—20 dBm
LOG/LINEAR	LOG
VIDEO FILTER	10 kHz

SIGNAL GENERATOR:

FREQUENCY	3 GHz
ATTENUATION	—20 dB
ALC CAL OUTPUT	0 dBm (on meter)

2. Adjust Signal Generator frequency to center signal in Preselector passband indicated by maximum signal level displayed on CRT.
3. Adjust Spectrum Analyzer FREQUENCY control to center signal on CRT display.
4. Record Signal Generator frequency. ____________
5. Adjust Spectrum Analyzer LOG REF LEVEL Vernier control to set signal peak on CRT LOG REF line.
6. Set Spectrum Analyzer INPUT ATTENUATION to 0 dB.
7. Tune Generator to a frequency 1 GHz above that recorded in step 4 above. Record frequency. ____________
8. Tune Spectrum Analyzer to frequency of Signal Generator.
9. Center Signal Generator signal on CRT display.
10. Reduce Spectrum Analyzer BANDWIDTH to 30 kHz and SCAN WIDTH PER DIVISION to 0.5 MHz. Center signal on CRT display with FINE TUNE control.
11. Set Analyzer INPUT ATTENUATION to 10 dB.
12. Note and record signal level. Signal should be at least 70 dB below the reference level set in step 5 above.

Out-of-Band Rejection ____________

4-15. LOW-PASS FILTER INSERTION LOSS TEST (omit for Option 004)

SPECIFICATION: Low-Pass Filter Insertion Loss; DC — 1.8 GHz: <2.5 dB, @ 2.05 GHz >50 dB.

DESCRIPTION: Insertion loss is measured at the high end of the filter's operating range by applying a known input power level and measuring the output power level. Filter rejection at 2.05 GHz is measured in the same manner.

4-15. LOW-PASS FILTER INSERTION LOSS TEST (cont'd)

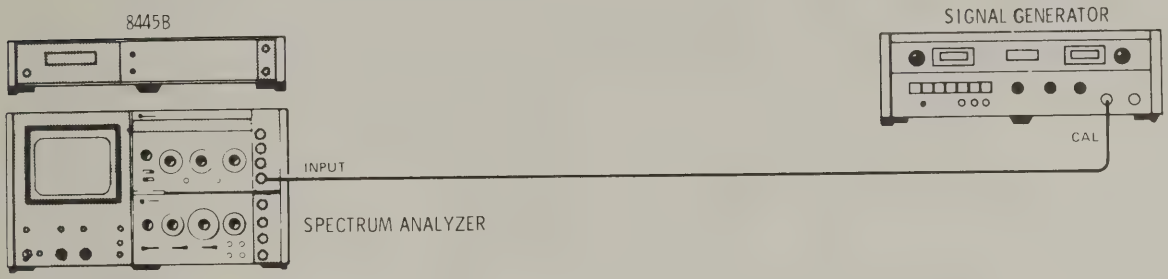


Figure 4-2. Insertion Loss Test Setup, DC — 1.8 GHz

EQUIPMENT:

Spectrum Analyzer	HP 8555A/8552/141T
Signal Generator	HP 8616B

1. Connect test setup as indicated in Figure 4-2 and make the following control settings:

PRESELECTOR:

LINE OFF/ON	ON

ANALYZER:

BAND	n=1 — (2.05 GHz IF)
FREQUENCY	1.8 GHz
BANDWIDTH	300 kHz
SCAN WIDTH PER DIVISION	10 MHz
INPUT ATTENUATION	10 dB
BASE LINE CLIPPER	9 o'clock
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG REF LEVEL	—20 dBm
LOG/LINEAR	LOG
VIDEO FILTER	10 kHz
SCAN MODE	INT
SCAN TRIGGER	AUTO
POWER	ON

SIGNAL GENERATOR:

LINE	On
RF	On
ALC	On
FREQUENCY	1800 MHz
ATTENUATION	10 dB

PERFORMANCE TESTS

4-15. LOW-PASS FILTER INSERTION LOSS TEST (cont'd)

2. Center 1.8 GHz signal on CRT display with FREQUENCY control. Set TUNING STABILIZER to ON and reduce SCAN WIDTH PER DIVISION to 100 kHz. Center signal on CRT display with FINE TUNE control.
3. Adjust Signal Generator CAL OUTPUT level for an indicated —20 dBm on CRT display.
4. Connect Signal Generator output to Preselector INPUT.
5. Connect Preselector OUTPUT to Analyzer INPUT.
6. Note and record signal level.

_______ dB

7. Insertion loss should not exceed 2.5 dB.
8. Record insertion loss.

≤2.5 dB _______ dB

9. Set Analyzer SCAN WIDTH PER DIVISION to 5 MHz.
10. Tune Analyzer and Signal Generator to 2050 MHz.
11. Note and record insertion loss.

≥50 dB _______ dB

4-16. YIG FILTER INSERTION LOSS TEST.

SPECIFICATION: Tracking Filter Insertion Loss: 1.8 — 12 GHz, 8 dB; Option 004 only; <7 dB, 12 — 18 GHz, <10 dB.

DESCRIPTION: YIG filter insertion loss is measured at fixed frequency points by applying a known signal level, tuning the YIG filter passband to the signal and measuring the power out the filter output port. Perform the operational adjustment procedure in Figure 3-5 prior to performing the test below. The operational adjustment procedure sets the FREQ OFFSET and TRACKING controls in addition to checking the insertion loss at 2.0 and 8.0 GHz. The YIG filter is tuned by applying a voltage to the REMOTE input. Voltage to frequency tuning ratio is 1 GHz/volt. The Preselector FREQ OFFSET control is used as a fine tuning control.

PERFORMANCE TESTS

4-16. YIG FILTER INSERTION LOSS TEST (cont'd)

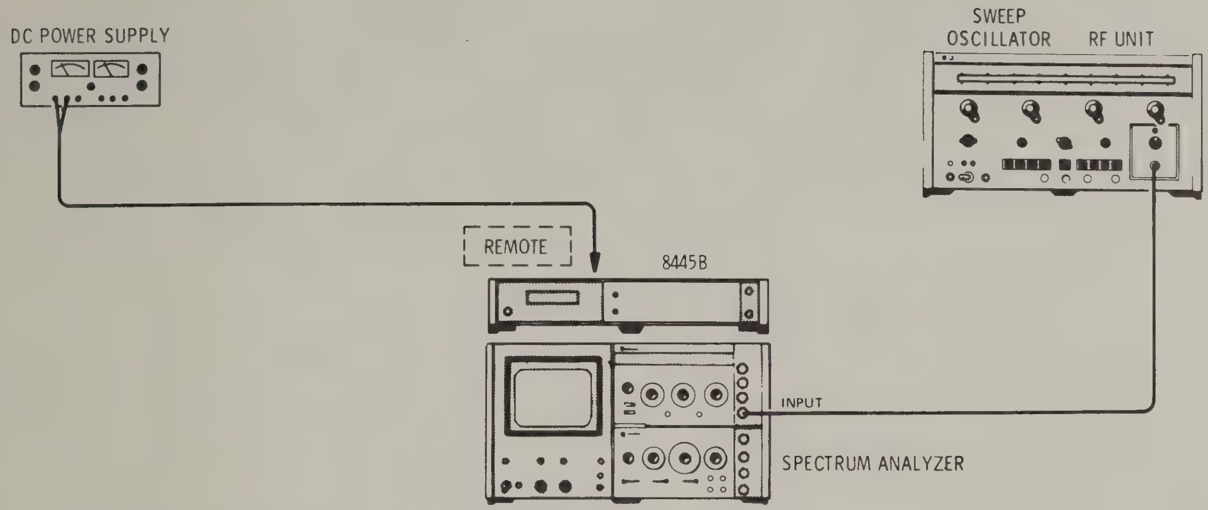


Figure 4-3. Insertion Loss Test Setup, 1.8 —18 GHz

EQUIPMENT:

Spectrum Analyzer	HP 8555A/8552/141T
Sweep Oscillators	HP 8690B/8692B/8693B/8694B/8695A
Power Supply	HP 6205B
Coaxial Cable (BNC to alligator clips)	HP 10501A

1. Connect test setup as indicated in Figure 4-3 and make the following control settings.

PRESELECTOR:

LINE OFF/ON	ON
MODE	REMOTE*

* Preselectors without manual controls, disconnect cable between Preselector and Display Section.

POWER SUPPLY:

POWER	ON
VOLTAGE	4.0 Vdc

SWEEP OSCILLATOR WITH 8692B RF UNIT:

LINE	RF
SWEEP SELECTOR	CW
START/CW	4.0 GHz
FUNCTION	START/STOP
ALC	On

ANALYZER:

BAND	n=2—
FREQUENCY	4.0 GHz

4-16. YIG FILTER INSERTION LOSS TEST (cont'd)

SCAN WIDTH PER DIVISION	10 MHz
INPUT ATTENUATION	10 dB
BASE LINE CLIPPER	9 o'clock
SCAN TIME PER DIVISION	10 MILLISECONDS
LOG REF LEVEL	−20 dBm
LOG LINEAR	LOG
VIDEO FILTER	OFF
SCAN MODE	INT
SCAN TRIGGER	AUTO
POWER	ON

2. Connect coaxial cable to REMOTE input on Preselector.

3. Connect center conductor of coaxial cable to "+" terminal on Power Supply.

4. Connect outer conductor of coaxial cable to "—" terminal on Power Supply.

5. Connect Sweep Oscillator RF Output to Spectrum Analyzer INPUT.

6. Reduce Spectrum Analyzer SCAN WIDTH PER DIVISION to 1 MHz. Center signal on CRT display with FREQUENCY control.

7. Set SIGNAL IDENTIFIER switch to ON. Perform signal identification to ensure signal displayed is result of n=2— mixing mode. Set SIGNAL IDENTIFIER switch to OFF.

8. Adjust Sweep Oscillator POWER LEVEL and/or Analyzer LOG REF LEVEL Vernier for a convenient signal level.

9. Record signal level.

   _______ dBm

10. Connect Sweep Oscillator RF output to Preselector INPUT.

11. Install rigid coaxial cable between Preselector OUTPUT and Spectrum Analyzer INPUT.

12. Adjust Power Supply Vernier voltage control for maximum signal level indication on CRT display.

NOTE

Tuning rate is critical. The frequency tuning of the Preselector passband is changed at a rate of 1 MHz/mV.

13. Adjust FREQ OFFSET to maximize signal level on CRT display.

14. Record signal level.

    _______ dBm

15. Subtract level recorded in step 9.

    − _______ dB

16. Record insertion loss at 4 GHz.

    _______ dB

17. Repeat the above procedure at selected frequency points to 18 GHz.

PERFORMANCE TESTS

4-17. LIMITING LEVEL TEST

SPECIFICATION: >+5 dBm for <1 dB signal compression.

DESCRIPTION: YIG filter compression is checked at the low frequency end of the operating range (point of maximum filter compression). Compression is measured by applying a −5 dBm signal to the filter input; the power level at the filter output is measured to establish a reference level. The input power level is increased by 10 dB and the output level is checked for a corresponding increase. In the actual test, a 10 dB fixed attenuator is switched from between the signal source and filter to the filter output. Using this procedure, any change in output level would be due to compression and not to errors in the measurement test setup.

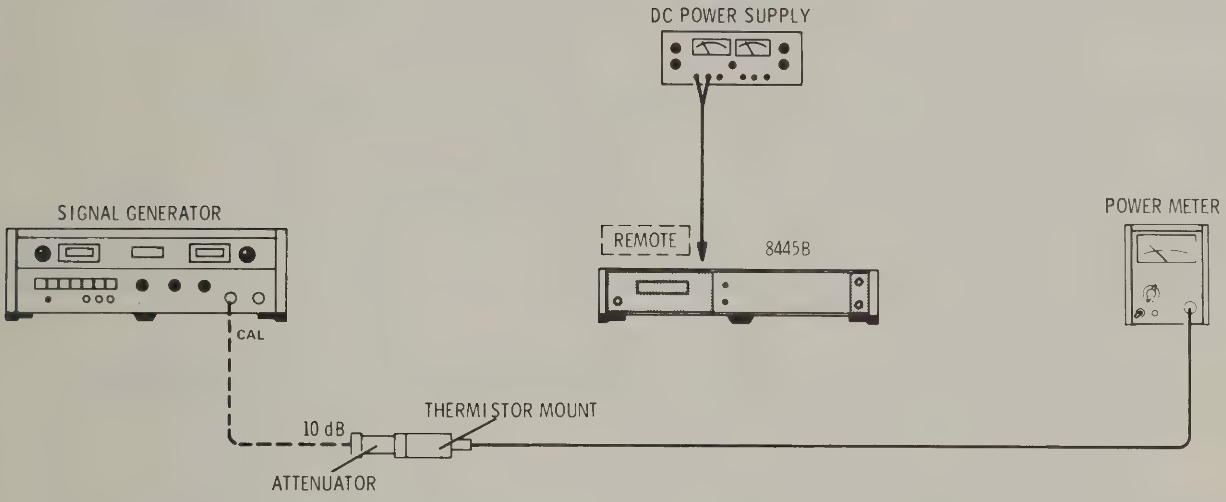


Figure 4-4. YIG Filter Signal Compression Test Setup

EQUIPMENT:

Power Meter	HP 432A
Thermistor Mount	HP 8478B
Power Supply	HP 6205B
Signal Generator	HP 8616B
10-dB Attenuator	HP 8491A

1. Connect test setup as indicated in Figure 4-4 and make the following control settings:

PRESELECTOR:

LINE OFF/ON . . . . ON

POWER SUPPLY:

Output Voltage . . . . 1.8 Vdc

4-17. LIMITING LEVEL TEST (cont'd)

SIGNAL GENERATOR:

LINE . . . . On
RF . . . . On
ALC . . . . On
FREQUENCY . . . . 1800 MHz

POWER METER:

POWER . . . . ON
RANGE . . . . —5 dBm
MOUNT RESISTANCE 200Ω

2. Adjust Signal Generator output level for an indication of —5 dBm on Power Meter.

3. Connect Signal Generator output through the 10 dB attenuator to Preselector INPUT.

4. Connect Power Meter and Thermistor Mount to Preselector OUTPUT.

5. Adjust Power Supply Fine Voltage control for maximum power level indication on Power Meter.

6. Adjust Preselector FREQ OFFSET control for maximum power level indication on Power Meter.

NOTE

Indicated power meter level should correspond with the insertion loss indicated on Preselector calibration label. Typically 4 dB below the level established in step 2 above.

7. Note and record level indicated on Power Meter.

________ dBm

8. Remove 10 dB Attenuator from Signal Generator to Preselector path and install in Preselector to Thermistor Mount and Power Meter path.

9. Note and record level indicated on Power Meter.

________ dBm

10. Record compression loss; difference between levels recorded in steps 9 and 7 above.

________ dB

Table 4-1. Performance Test Card

Hewlett-Packard Model 8445B
Preselector

Test Performed by ____________________

Instrument's Serial No.
8445B : ______________
8555A: ______________
8552 : ______________
140 : ______________

Date ____________________

Para. No.	Test Description	Measurement Unit	Min	Actual	Max
4-14.	**Out-of-Band Rejection**				
	Reference Frequency	GHz			
	Measurement Frequency	GHz			
	Out-of-Band Rejection	dB	70		
4-15.	**Low-Pass Filter Insertion Loss**				
	Reference Level	dBm			
	Insertion Loss	dB			2.5
	2050 MHz Insertion Loss	dB	50		
4-16.	**Yig Filter Insertion Loss**				
	Reference Frequency	GHz			
	Reference Signal Level	dBm			
	Preselector Signal Level	dBm			
	Insertion Loss	dB			*
	*See Specification				
	Reference Frequency	GHz			
	Reference Signal Level	dBm			
	Preselector Signal Level	dBm			
	Insertion Loss	dB			*
	Reference Frequency	GHz			
	Reference Signal Level	dBm			
	Preselector Signal Level	dBm			
	Insertion Loss	dB			*
	*See Specification				
4-17.	**Limiting Level**				
	Reference Frequency	GHz			
	Reference Level	dBm			
	Measurement Level	dBm			
	Compression Loss	dB			1

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments required to return the Preselector to peak operating condition when repairs are required. Included in this section are test setups, checks, and adjustment procedures. Adjustment location drawings or photographs are contained in the test setup and/or the component location figures adjacent to the schematic diagrams in Section VIII.

5-3. The adjustment procedures are arranged in numerical order. For best results, this order should be followed. Record data taken during adjustments in the spaces provided. Comparison of initial data with data taken during periodic adjustments assists in preventive maintenance and troubleshooting.

5-4. EQUIPMENT REQUIRED

5-5. Each adjustment procedure contains a list of test equipment for that particular test. Table 1-4 contains a list of test equipment and accessories required in the adjustment procedures. In addition, the table contains the required minimum specifications and a suggested manufacturer's model number.

5-6. FACTORY SELECTED COMPONENTS

5-7. Table 8-1 contains a list of factory selected components by reference designation, basis of selection, and schematic diagram location on which the component is illustrated. Factory selected components are designated by an asterisk(*) on the schematic diagrams in Section VIII of this manual.

WARNING

Line voltage is always present on terminals including the power input connector, fuse holder, power switch, etc. In addition, when the instrument is on, energy available at many points may result in personal injury or death when contacted.

ADJUSTMENTS

5-8. POWER SUPPLIES ADJUSTMENT

REFERENCE: Service Sheet 6.

DESCRIPTION: Power supplies in the Preselector provide regulated outputs of +19.5 and —23 volts and an unregulated output of +40 volts. Only the +19.5 volt supply is adjustable. These checks verify proper operation of the power supplies.

ADJUSTMENTS

5-8. POWER SUPPLIES ADJUSTMENT (cont'd)

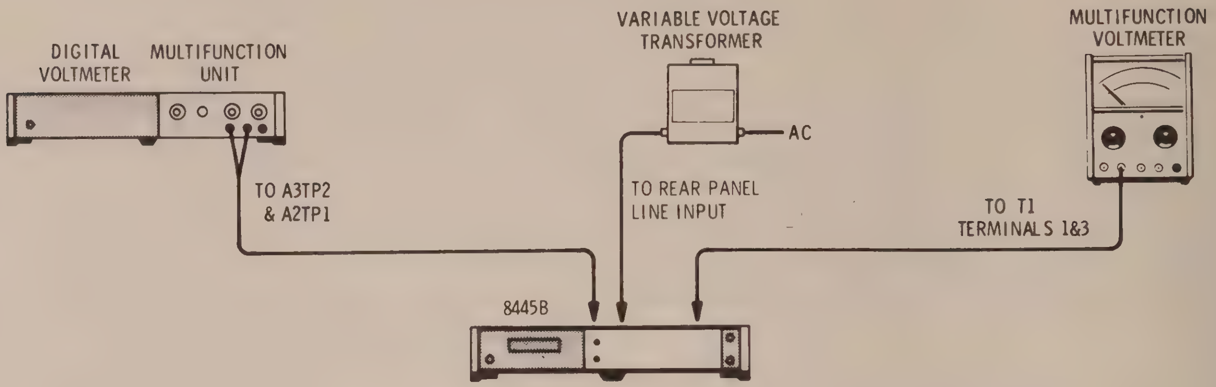


Figure 5-1. Power Supply Adjustment Test Setup

EQUIPMENT:

Digital Voltmeter with 3484A Multifunction Unit	HP 3480B
AC Voltmeter	HP 410C
Variable Voltage Transformer	General Radio W5MT3A

NOTE

Unless otherwise specified, all dc voltages are measured with respect to test point A3TP2.

PROCEDURE:

1. Connect test setup as indicated in Figure 5-1.

2. Remove top cover from Preselector and connect digital voltmeter test leads to A2TP1 (+19.5 Vdc) and A3TP2 (signal/reference ground). Connect AC voltmeter to terminals 1 and 3 of power transformer T1.

NOTE

This test procedure assumes that the available line voltage is 120 Vdc. If it is not, substitute the available line voltage values in the procedure and vary +5% and —10% where appropriate.

3. Apply power to Preselector, measure and record the +19.5 volt output. Vary the ac line voltag from 108 to 126 volts. The +19.5 volt regulated output should not vary more than 20 mV.

AC Input	+19.5 Vdc Output
108	______
120	______
126	______

5-8. POWER SUPPLIES ADJUSTMENT (cont'd)

4. Set ac line voltage to 120 volts. Adjust A2R5 for 19.5 Vdc ±20 mV at A2TP1. Measure and record the dc levels at test point locations listed below.

Location	Normal	Actual
A4 pin 1	+40 Vdc*	______
A2 pins 9/K	—23 Vdc ±10%	______

*Verify that the +40 Vdc supply will vary from approximately +40 with the YIG Filter tuned to 2 GHz; to +30 Vdc at 18 GHz.

5. If the dc supplies are out of tolerance, refer to Service Sheet 6 for trouble isolation procedure.

5-9. PRE-DRIVER ADJUSTMENT

REFERENCE: Service Sheets 3 *and 3A.*

DESCRIPTION: With the Preselector connected to the Spectrum Analyzer, the Pre-Driver is checked and adjusted for an output voltage that tracks the tuning response of the Spectrum Analyzer. All operational amplifiers are adjusted for balance and checked for correct gain. Voltage offset is adjusted to correspond to the 550 MHz or 2050 MHz IF of the Spectrum Analyzer.

NOTE

Instructions in *italics* refer to Option 003 instruments only.

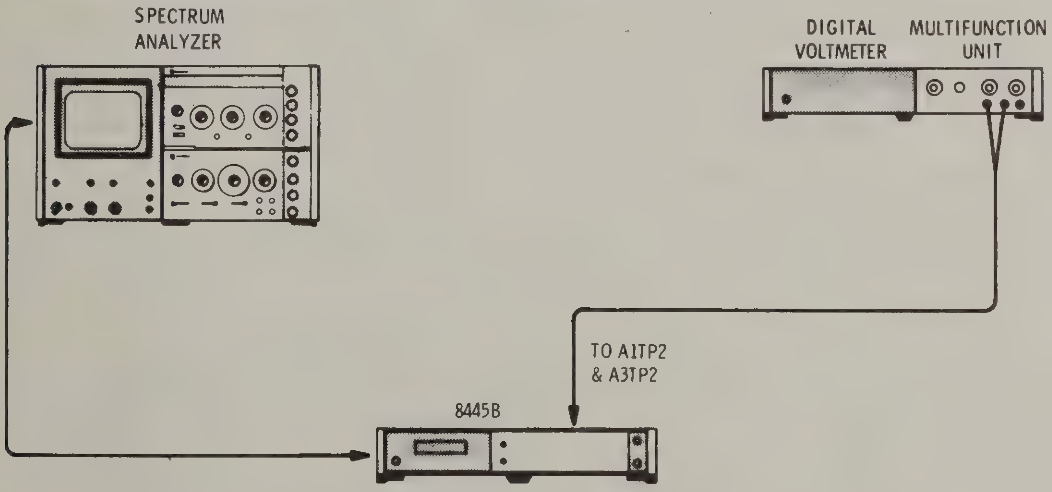


Figure 5-2. Pre-Driver Adjustment Test Setup

EQUIPMENT:

Spectrum Analyzer . . . . HP 8555A/8552/141T
Digital Voltmeter with 3484A Multifunction Unit . . . . HP 3480B

5-9. PRE-DRIVER ADJUSTMENT (cont'd)

NOTE

For Option 003 instruments the A7 Digital Display Assembly must be removed prior to any Pre-Driver adjustments. Remove A7 by disconnecting the input cable on the rear of the assembly and by removing one screw from the mounting bracket adjacent to the "P1" marking on the main deck.

PROCEDURE:

1. Connect test setup as indicated in Figure 5-2.

2. Apply power to both Preselector and Spectrum Analyzer. Allow at least 30 minutes for equipment stabilization.

3. Set Spectrum Analyzer controls as follows:

BAND	n=2—
SCAN WIDTH PER DIVISION	1 MHz
SCAN WIDTH	ZERO
INPUT ATTENUATION	10 dB
SCAN TIME PER DIVISION	10 MILLISECONDS
SCAN MODE	INT
SCAN TRIGGER	AUTO
LOG/LINEAR	LOG
LOG REFERENCE LEVEL	—10 dBm

NOTE

Unless otherwise specified, all dc voltages are measured with respect to ground test point, A3TP2.

4. Set switch A1S1 *and A1S2* to TEST position.

5. Set switch A3S1 to TEST position.

6. Set the voltage at the following test points (in specified order) with the appropriate pot.

Test Point	Adjust	Limits
A1TP2	A1R34	0.00 ± 0.20 mV
A1TP5	A1R42	0.00 ± 0.20 mV
A1TP7	A1R35	0.00 ± 0.20 mV
A1TP4	*A1R38*	*0.00 ± 0.20 mV*
A1TP6	*A1R46*	*0.00 ± 0.20 mV*
A1TP8	*A1R39*	*0.00 ± 0.20 mV*

7. Set A3S1 to OPR.

8. Adjust A1R37 *and A1R41* to obtain +2.000 V at A1TP7 *and A1TP8 respectively.*

9. Set Spectrum Analyzer BAND to n=2+ and verify voltage at A1TP7 *and A1TP8*. Voltage should be —2.000 ±0.002 V.

—1.998______________—2.002 V

5-9. PRE-DRIVER ADJUSTMENT (cont'd)

10. Set BAND to $n=1^{+*}$ (550 MHz IF). Adjust A1R36 *and A1R40* to obtain —536.6 mV at A1TP7 *and A1TP8 respectively.*

11. Set BAND to $n=1^{-*}$ and verify voltage at A1TP7 *and A1TP8*. Voltage should be +536.6 ±2.0 mV.

+534.6__________+538.6 mV

12. St A1S1 *and A1S2* to OPR, A3S1 to TEST, and BAND to $n=1^{-*}$.

13. Adjust Spectrum Analyzer FREQUENCY for —3.000 V at A1TP7 in Preselector.

14. Check voltage at A1TP7 versus BAND setting.

Band	A1TP7 Voltage
$n=1^{+*}$	—2.998__________—3.002V
$n=1^{-}$	—2.998__________—3.002V
$n=1^{+}$	—2.998__________—3.002V
$n=2^{-}$	—5.997__________—6.003V
$n=2^{+}$	—5.997__________—6.003V
$n=3^{-}$	—8.996__________—9.004V
$n=3^{+}$	—8.996__________—9.004V
$n=4^{-}$	—11.995__________—12.005V
$n=4^{+}$	—11.995__________—12.005V

15. *Set BAND to $n=1^{+*}$ and adjust FREQUENCY control for —3.000 V at A1TP8.*

16. *Check voltage and A1TP8 versus BAND setting. Use same limits as in step 14.*

17. *Set A3S1 to OPR.*

5-10. REMOTE AMPLIFIER ADJUSTMENT

REFERENCE: Service Sheet 5.

DESCRIPTION: The remote amplifier A2U3 is adjusted for null, common-mode and differential-mode. The adjustments are repeated until settings are found that satisfy null, common-mode and differential-mode requirements.

ADJUSTMENTS

5-10. REMOTE AMPLIFIER ADJUSTMENT (cont'd)

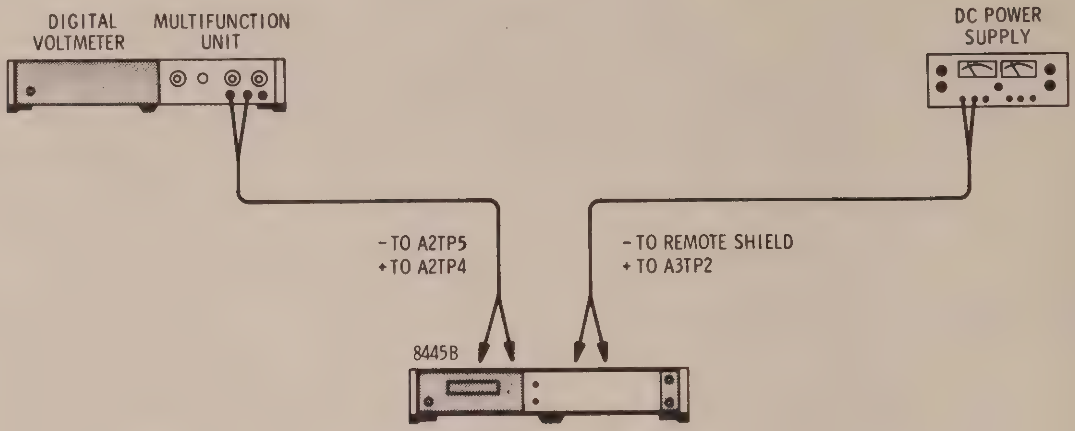


Figure 5-3. Remote Amplifier Adjustment Test Setup

EQUIPMENT:

Power Supply (0 to 10 Vdc)	HP 6205B
Coaxial Cable (BNC to alligator clips)	HP 10501A
Four foot test leads with alligator clips (2 each)	
Digital Voltmeter with 3484A Multifunction Unit	HP 3480B

1. With test setup as indicated in Figure 5-3, apply power to Preselector and allow at least 30 minutes for equipment to stabilize.

2. Connect "+" terminal of power supply to A3TP2.

3. Connect "—" terminal of power supply to REMOTE connector shield.

4. Connect "+" terminal of digital voltmeter to A2TP4.

5. Connect "—" terminal of digital voltmeter to A2TP5.

6. Set power supply output voltage to zero and connect REMOTE connector center conductor to "—" terminal of power supply. (REMOTE center pin and shield now shorted together.)

7. Adjust A2R23 NULL for zero indication on digital voltmeter. Remove short across REMOTE Center pin and shield.

8. Common-mode adjustment:

   a. Set power supply output voltage to 10 volts.

   b. Note error voltage indicated by voltmeter.

   c. Alternately adjust A2R20 and A2R21 for a zero indication on voltmeter. Remove about half the error voltage with each potentiometer.

9. Differential-mode adjustment:

   a. Set power supply output voltage to zero.

   b. Connect REMOTE connector center conductor to "+" terminal of power supply.

ADJUSTMENTS

5-10. REMOTE AMPLIFIER ADJUSTMENT (cont'd)

c. Connect "—" terminal of digital voltmeter to A2TP2.

d. Adjust A2R23 NULL for zero indication on voltmeter.

e. Set Power Supply output voltage to 10 volts.

f. Alternately adjust A2R20 and A2R21 for zero indication on voltmeter, removing about half the error voltage with each potentiometer.

10. Repeat steps 2 through 9 until settings are found which simultaneously satisfy all modes within a tolerance of ±1.0 millivolts.

11. Note and record digital voltmeter indication for each mode.

Common-mode_________mV
Differential-mode_________mV

5-11. YIG DRIVER ADJUSTMENT

REFERENCE: Service Sheet 4.

DESCRIPTION: The YIG Driver is adjusted for linear frequency tracking with voltage. Operational amplifier A3U1 is adjusted for null. Front panel controls are adjusted to provide correct frequency offset and tracking. The YIG linearity correction breakpoints are adjusted to tune the filter bandpass to fixed frequency points for fixed input voltages. The linearity breakpoints compensate for saturation in the YIG core at the higher frequencies.

5-11. YIG DRIVER ADJUSTMENT (cont'd)

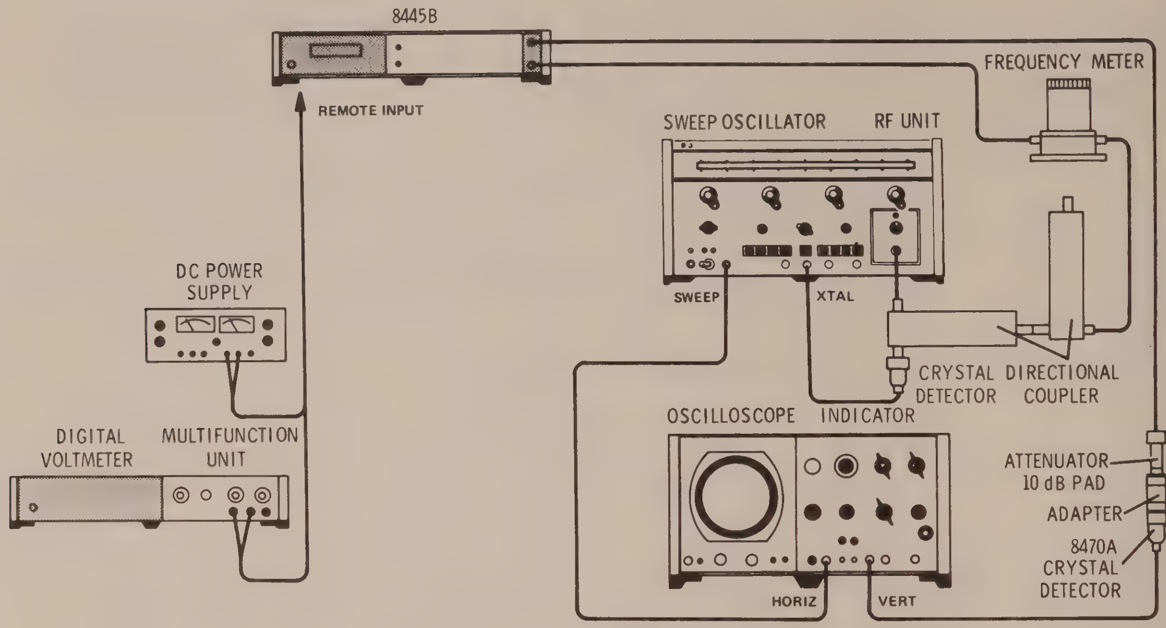


Figure 5-4. YIG Driver Adjustment Test Setup

EQUIPMENT:

Sweep Oscillator	HP 8690B
RF Unit	HP 8692B
RF Unit	HP 8694B
RF Unit	HP 8695A
Swept Frequency Indicator	HP 1416A
Oscilloscope/Display Section	HP 140 Series
Power Supply	HP 6205B
Frequency Meter	HP 536A
Frequency Meter	HP 537A
Frequency Meter	HP P532A
Digital Voltmeter with 3484A Multifunction Unit	HP 3480B
Directional Coupler (2 each)	HP 779D
Crystal Detector	HP 8470A
Coaxial Attenuator, 10 dB	HP 8491B
Crystal Detector	HP 423A
Adapter APC-7 to Type N male	HP 11525A

1. Connect test setup as indicated in Figure 5-5. Apply power and allow at least 30 minutes for equipment to stabilize.

NOTE

Perform the Power Supply and Pre-Driver Adjustment prior to performing the YIG Driver Adjustments.

2. Set the Preselector for remote operation and position the FREQ OFFSET control, R1, full ccw.

3. Center the panel TRACKING pot, R2.

ADJUSTMENTS

5-11. YIG DRIVER ADJUSTMENT (cont'd)

4. Adjust the power supply (connected to REMOTE jack) for 0 ±1 mV at A3TP4. Adjust A3R7 for 0 ±1 mV at A3TP3.
5. Adjust power supply for 13.66 ±0.01 V at A3TP4 (equivalent to 14.00 V at REMOTE input).
6. Set the sweep oscillator for 14 GHz with a 0.5 GHz ΔF sweep, and set wavemeter to 14 GHz.
7. Adjust A3R21 COURSE TRACKING to center wavemeter dip in YIG filter passband. If A3R21 has insufficient range, select values of A3R13 until A3R21 adjustment can be made.
8. Adjust power supply for 1.951 ±1 mV at A3TP4 (equivalent to 2.000 V at REMOTE input).
9. Set sweep oscillator to 2 GHz with a 0.2 GHz ΔF sweep and set wavemeter to 2 GHz.
10. Adjust FREQ OFFSET control to center wavemeter dip in filter passband.
11. Since the COURSE TRACKING and FREQ OFFSET adjustments interact, repeat steps 5 through 10.
12. Set power supply for 15.61 ±0.01 V at A3TP4 (equivalent to 16.00 V at REMOTE input).
13. Set sweep oscillator to 16 GHz with a 0.5 GHz ΔF sweep and set wavemeter to 16 GHz.
14. Adjust A3R24 16 GHz ADJ to center wavemeter dip in filter passband.
15. Set power supply for 17.56 ±0.01 V at A3TP4 (equivalent to 18.00 V at REMOTE input).
16. Set sweep oscillator and wavemeter to 18 GHz.
17. Adjust A3R29 18 GHz ADJ to center wavemeter dip in filter passband.

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering parts. Table 6-1 is a list of abbreviations used in the parts list and throughout the manual. Table 6-2 lists all replaceable parts in reference designator order. Table 6-3 contains the names and addresses that correspond to the manufacturers' code numbers.

6-3. ABBREVIATIONS

6-4. Table 6-1 lists abbreviations used in the parts list, schematics and throughout the manual. In some cases, two forms of the abbreviation are used, one all in capital letters, and one partial or no capitals. This occurs because the abbreviations in the parts list are always all capitals. However, in the schematics and other parts of the manual, other abbreviation forms are used with both lower case and upper case letters.

6-5. REPLACEABLE PARTS LIST

6-6. Table 6-2 is the list of replaceable parts and is organized as follows:

a. Electrical assemblies and their components in alpha-numerical order by reference designation.

b. Chassis-mounted parts in alpha-numerical order by reference designation.

c. Miscellaneous parts.

d. Illustrated parts breakdown.

The information given for each part consists of the following:

a. The Hewlett-Packard part number.

b. The total quantity (Qty) in the instrument.

c. The description of the part.

d. A typical manufacturer of the part in a five-digit code.

e. The manufacturer's number for the part.

The total quantity for each part is given only once — at the first appearance of the part number in the list.

6-7. ORDERING INFORMATION

6-8. To order a part listed in the replaceable parts table, quote the Hewlett-Packard part number, indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

6-9. To order a part that is not listed in the replaceable parts table, include the instrument model number, instrument serial number, the description and function of the part, and the number of parts required. Address the order to the nearest Hewlett-Packard office.

Table 6-1. Reference Designations and Abbreviations (1 of 2)

REFERENCE DESIGNATIONS

A	assembly
AT	attenuator; isolator; termination
B	fan; motor
BT	battery
C	capacitor
CP	coupler
CR	diode; diode thyristor; varactor
DC	directional coupler
DL	delay line
DS	annunciator; signaling device (audible or visual); lamp; LED
E	miscellaneous electrical part
F	fuse
FL	filter
H	hardware
HY	circulator
J	electrical connector (stationary portion); jack
K	relay
L	coil; inductor
M	meter
MP	miscellaneous mechanical part
P	electrical connector (movable portion); plug
Q	transistor: SCR; triode thyristor
R	resistor
RT	thermistor
S	switch
T	transformer
TB	terminal board
TC	thermocouple
TP	test point
U	integrated circuit; microcircuit
V	electron tube
VR	voltage regulator; breakdown diode
W	cable; transmission path; wire
X	socket
Y	crystal unit (piezo-electric or quartz)
Z	tuned cavity; tuned circuit

ABBREVIATIONS

A	ampere
ac	alternating current
ACCESS	accessory
ADJ	adjustment
A/D	analog-to-digital
AF	audio frequency
AFC	automatic frequency control
AGC	automatic gain control
AL	aluminum
ALC	automatic level control
AM	amplitude modulation
AMPL	amplifier
APC	automatic phase control
ASSY	assembly
AUX	auxiliary
avg	average
AWG	American wire gauge
BAL	balance
BCD	binary coded decimal
BD	board
BE CU	beryllium copper
BFO	beat frequency oscillator
BH	binder head
BKDN	breakdown
BP	bandpass
BPF	bandpass filter
BRS	brass
BWO	backward-wave oscillator
CAL	calibrate
ccw	counter-clockwise
CER	ceramic
CHAN	channel
cm	centimeter
CMO	cabinet mount only
COAX	coaxial
COEF	coefficient
COM	common
COMP	composition
COMPL	complete
CONN	connector
CP	cadmium plate
CRT	cathode-ray tube
CTL	complementary transistor logic
CW	continuous wave
cw	clockwise
cm	centimeter
D/A	digital-to-analog
dB	decibel
dBm	decibel referred to 1 mW
dc	direct current
deg	degree (temperature interval or difference)
°	degree (plane angle)
°C	degree Celsius (centigrade)
°F	degree Fahrenheit
°K	degree Kelvin
DEPC	deposited carbon
DET	detector
diam	diameter
DIA	diameter (used in parts list)
DIFF AMPL	differential amplifier
div	division
DPDT	double-pole, double-throw
DR	drive
DSB	double sideband
DTL	diode transistor logic
DVM	digital voltmeter
ECL	emitter coupled logic
EMF	electromotive force
EDP	electronic data processing
ELECT	electrolytic
ENCAP	encapsulated
EXT	external
F	farad
FET	field-effect transistor
F/F	flip-flop
FH	flat head
FIL H	fillister head
FM	frequency modulation
FP	front panel
FREQ	frequency
FXD	fixed
g	gram
GE	germanium
GHz	gigahertz
GL	glass
GRD	ground(ed)
H	henry
h	hour
HET	heterodyne
HEX	hexagonal
HD	head
HDW	hardware
HF	high frequency
HG	mercury
HI	high
HP	Hewlett-Packard
HPF	high pass filter
HR	hour (used in parts list)
HV	high voltage
Hz	Hertz
IC	integrated circuit
ID	inside diameter
IF	intermediate frequency
IMPG	impregnated
in	inch
INCD	incandescent
INCL	include(s)
INP	input
INS	insulation
INT	internal
kg	kilogram
kHz	kilohertz
kΩ	kilohm
kV	kilovolt
lb	pound
LC	inductance-capacitance
LED	light-emitting diode
LF	low frequency
LG	long
LH	left hand
LIM	limit
LIN	linear taper (used in parts list)
lin	linear
LK WASH	lock washer
LO	low; local oscillator
LOG	logrithmic taper (used in parts list)
log	logrithm(ic)
LPF	low pass filter
LV	low voltage
m	meter (distance)
mA	milliampere
MAX	maximum
MΩ	megohm
MEG	meg (10^6) (used in parts list)
MET FLM	metal film
MET OX	metallic oxide
MF	medium frequency; microfarad (used in parts list)
MFR	manufacturer
mg	milligram
MHz	megahertz
mH	millihenry
mho	mho
MIN	minimum
min	minute (time)
'	minute (plane angle)
MINAT	minature
mm	millimeter

NOTE

All abbreviations in the parts list will be in upper-case.

Table 6-1. Reference Designations and Abbreviations (2 of 2)

MOD	modulator
MOM	momentary
MOS	metal-oxide semiconductor
ms	millisecond
MTG	mounting
MTR	meter (indicating device)
mV	millivolt
mVac	millivolt, ac
mVdc	millivolt, dc
mVpk	millivolt, peak
mVp-p	millivolt, peak-to-peak
mVrms	millivolt, rms
mW	milliwatt
MUX	multiplex
MY	mylar
μA	microampere
μF	microfarad
μH	microhenry
μmho	micromho
μs	microsecond
μV	microvolt
μVac	microvolt, ac
μVdc	microvolt, dc
μVpk	microvolt, peak
μVp-p	microvolt, peak-to-peak
μVrms	microvolt, rms
μW	microwatt
nA	nanoampere
NC	no connection
N/C	normally closed
NE	neon
NEG	negative
nF	nanofarad
NI PL	nickel plate
N/O	normally open
NOM	nominal
NORM	normal
NPN	negative-positive-negative
NPO	negative-positive zero (zero temperature coefficient)
NRFR	not recommended for field replacement
NSR	not separately replaceable
ns	nanosecond
nW	nanowatt
OBD	order by description
OD	outside diameter
OH	oval head
OP AMPL	operational amplifier
OPT	option
OSC	oscillator
OX	oxide
oz	ounce
Ω	ohm
P	peak (used in parts list)
PAM	pulse-amplitude modulation
PC	printed circuit
PCM	pulse-code modulation; pulse-count modulation
PDM	pulse-duration modulation
pF	picofarad
PH BRZ	phosphor bronze
PHL	Phillips
PIN	positive-intrinsic-negative
PIV	peak inverse voltage
pk	peak
PL	phase lock
PLO	phase lock oscillator
PM	phase modulation
PNP	positive-negative-positive
P/O	part of
POLY	polystyrene
PORC	porcelain
POS	positive; position(s) (used in parts list)
POSN	position
POT	potentiometer
p-p	peak-to-peak
PP	peak-to-peak (used in parts list)
PPM	pulse-position modulation
PREAMPL	preamplifier
PRF	pulse-repetition frequency
PRR	pulse repetition rate
ps	picosecond
PT	point
PTM	pulse-time modulation
PWM	pulse-width modulation
PWV	peak working voltage
RC	resistance-capacitance
RECT	rectifier
REF	reference
REG	regulated
REPL	replaceable
RF	radio frequency
RFI	radio frequency interference
RH	round head; right hand
RLC	resistance-inductance-capacitance
RMO	rack mount only
rms	root-mean-square
RND	round
ROM	read-only memory
R&P	rack and panel
RWV	reverse working voltage
S	scattering parameter
s	second (time)
”	second (plane angle)
S-B	slow-blow (fuse) (used in parts list)
SCR	silicon controlled rectifier; screw
SE	selenium
SECT	sections
SEMICON	semiconductor
SHF	superhigh frequency
SI	silicon
SIL	silver
SL	slide
SNR	signal-to-noise ratio
SPDT	single-pole, double-throw
SPG	spring
SR	split ring
SPST	single-pole, single-throw
SSB	single sideband
SST	stainless steel
STL	steel
SQ	square
SWR	standing-wave ratio
SYNC	synchronize
T	timed (slow-blow fuse)
TA	tantalum
TC	temperature compensating
TD	time delay
TERM	terminal
TFT	thin-film transistor
TGL	toggle
THD	thread
THRU	through
TI	titanium
TOL	tolerance
TRIM	trimmer
TSTR	transistor
TTL	transistor-transistor logic
TV	television
TVI	television interference
TWT	traveling wave tube
U	micro (10^{-6}) (used in parts list)
UF	microfarad (used in parts list)
UHF	ultrahigh frequency
UNREG	unregulated
V	volt
VA	voltampere
Vac	volts, ac
VAR	variable
VCO	voltage-controlled oscillator
Vdc	volts, dc
VDCW	volts, dc, working (used in parts list)
V(F)	volts, filtered
VFO	variable-frequency oscillator
VHF	very-high frequency
Vpk	volts, peak
Vp-p	volts, peak-to-peak
Vrms	volts, rms
VSWR	voltage standing wave ratio
VTO	voltage-tuned oscillator
VTVM	vacuum-tube voltmeter
V(X)	volts, switched
W	watt
W/	with
WIV	working inverse voltage
WW	wirewound
W/O	without
YIG	yttrium-iron-garnet
Z_o	characteristic impedance

NOTE

All abbreviations in the parts list will be in upper-case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
μ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08445-60101	1	YIG PREDRIVER ASSY (DELETE FOR OPTION 003)	28480	08445-60101
A1CR1	1901-0025	26	DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR5	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR6	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR8	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1CR9	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1K1	0490-0367	6	RELAY:REED 2.75K OHM	28480	0490-0367
A1K2	0490-0367		RELAY:REED 2.75K OHM	28480	0490-0367
A1K5	0490-0760	10	RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1K7	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1K8	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1Q1	1854-0071	20	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1R1	0757-0458	13	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R2	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R3	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R4	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1R5	0757-0401	14	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R6	0757-0447	3	R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1R7	0811-3007	20	R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R8	0698-3157	11	R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R9	0757-0440	3	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1R10	0757-0442	8	R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1R11	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R12	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R13	0757-0441	3	R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A1R14	0757-0438	3	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1R15	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R16	0811-3008	12	R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1R17	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1R18	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R19	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1R20	0811-3009	3	R:FXD WW 44.0K OHM 1.0% 1/8W	28480	0811-3009
A1R21	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1R22	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R23	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R24	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R25	0811-3112	3	R:FXD WW 117.5K OHM 1.0% 1W	28480	0811-3112
A1R26	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R27	0698-3155	2	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1R28	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R29	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1R30	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1R31	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1R34	2100-1776	14	R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1R35	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1R36	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1R37	2100-1774	4	R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A1R42	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1S1	3101-1162	4	SWITCH:SLIDE MINIATURE, SPDT	79727	GF124-0008
A1TP1	0360-1514	30	TERMINAL PIN:SQUARE	28480	0360-1514
A1TP2	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1TP5	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1TP7	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1U1	1826-0013	12	IC:LINEAR	28480	1826-0013
A1U2	1826-0013		IC:LINEAR	28480	1826-0013
A1U5	1826-0013		IC:LINEAR	28480	1826-0013
A1VR1	1902-0041	6	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1VR2	1902-0184	7	DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A1VR3	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1VR4	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08445-60102	1	PREDRIVER ASSY (OPTION 003 ONLY)	28480	08445-60102
A1 CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR5	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR6	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR8	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR9	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR10	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 CR11	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1 K1	0490-0367		RELAY:REED 2.75K OHM	28480	0490-0367
A1 K2	0490-0367		RELAY:REED 2.75K OHM	28480	0490-0367
A1 K3	0490-0367		RELAY:REED 2.75K OHM	28480	0490-0367
A1 K4	0490-0367		RELAY:REED 2.75K OHM	28480	0490-0367
A1 K5	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K6	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K7	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K8	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K9	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K10	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 K11	0490-0760		RELAY:REED 0.1AMP MAX. 250V MIN.	28480	0490-0760
A1 Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q2	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A1 R1	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1 R2	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1 R3	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1 R4	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1 R5	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R6	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1 R7	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R8	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R9	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1 R10	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1 R11	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R12	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R13	0757-0441		R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A1 R14	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1 R15	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R16	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R17	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R18	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R19	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R20	0811-3009		R:FXD WW 44.0K OHM 1.0% 1/8W	28480	0811-3009
A1 R21	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R22	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R23	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R24	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R25	0811-3112		R:FXD WW 117.5K OHM 1.0% 1W	28480	0811-3112
A1 R26	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R27	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1 R28	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R29	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R30	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R31	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R32	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R33	0757-0447		R:FXD MET FLM 16.2K OHM 1% 1/8W	28480	0757-0447
A1 R34	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R35	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R36	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R37	2100-1774		R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A1 R38	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R39	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R40	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1 R41	2100-1774		R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A1 R42	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R43	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R44	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R45	0698-3160	2	R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A1 R46	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A1 R47	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A1 R48	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A1 R49	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R50	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R51	0757-0441		R:FXD MET FLM 8.25K OHM 1% 1/8W	28480	0757-0441
A1 R52	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A1 R53	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R54	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R55	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R56	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R57	0811-3009		R:FXD WW 44.0K OHM 1.0% 1/8W	28480	0811-3009
A1 R58	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R59	0811-3008		R:FXD WW 8K OHM 0.01% 1/32W	28480	0811-3008
A1 R60	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 R61	0811-3112		R:FXD WW 117.5K OHM 1.0% 1W	28480	0811-3112
A1 R62	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R63	0698-3155	1	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A1 R64	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A1 R65	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A1 R66	0698-3157		R:FXD MET FLM 19.6K OHM 1% 1/8W	28480	0698-3157
A1 R67	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A1 S1	3101-1162		SWITCH:SLIDE MINIATURE, SPDT	79727	GF124-0008
A1 S2	3101-1162		SWITCH:SLIDE MINIATURE, SPDT	79727	GF124-0008
A1 TP1	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP2	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP3	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP4	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP5	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP6	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP7	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP8	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 TP9	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A1 U1	1826-0013		IC:LINEAR	28480	1826-0013
A1 U2	1826-0013		IC:LINEAR	28480	1826-0013
A1 U3	1826-0013		IC:LINEAR	28480	1826-0013
A1 U4	1826-0013		IC:LINEAR	28480	1826-0013
A1 U5	1826-0013		IC:LINEAR	28480	1826-0013
A1 U6	1826-0013		IC:LINEAR	28480	1826-0013
A1 VR1	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1 VR2	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A1 VR3	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1 VR4	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A1 VR5	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1 VR6	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A1 VR7	1902-0041		DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A1 VR8	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A2	08445-60114	1	POWER SUPPLY ASSY	28480	08445-60114
A2C1	0160-2055	19	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A2C3	0180-1819	1	C:FXD AL ELECT 100 UF +75-10% 50VDCW	56289	30D107G050DH2-DSM
A2C4	0180-2181	1	C:FXD ELECT 1300 UF +75-10% 50VDCW	56289	36D132G050AA2A-DQB
A2C5	0160-3459	1	C:FXD CER 0.02 UF 20% 100VDCW	56289	C023F101H203MS22CDH
A2C6	0160-3466	1	C:FXD CER 100 PF 10% 250VDCW	56289	C157F251F101KS22-CDH
A2CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A2CR5	1901-0040	2	DIODE:SILICON 50 MA 30 WV	07263	FDG1088
A2CR6	1901-0200	4	DIODE:SI 3 A 100 PRRV	28480	1901-0200
A2CR7	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A2CR8	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A2CR9	1901-0200		DIODE:SI 3 A 100 PRRV	28480	1901-0200
A2CR10	1901-0159	4	DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A2CR11	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A2CR12	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2CR13	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A2F1	2110-0012	2	FUSE:0.5 AMP 250V	75915	312.500
A2F2	2110-0027	1	FUSE:0.125A 250V	75915	312.125
A2MP1	1205-0011	1	HEAT DISSIPATOR:FOR TO-5 AND TO-9 CASES	98978	TXBF-032-025B
A2MP2	1205-0085	1	HEAT SINK:SEMICONDUCTOR	13103	6166B BASE ONLY
A2MP3	2110-0269	4	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A2Q1	1854-0072	2	TSTR:SI NPN	80131	2N3054
A2Q2	1854-0022	4	TSTR:SI NPN	07263	S17843
A2Q3	1853-0012	4	TSTR:SI PNP	80131	2N2904A
A2Q4	1854-0022		TSTR:SI NPN	07263	S17843
A2Q5	1854-0022		TSTR:SI NPN	07263	S17843
A2Q6	1853-0012		TSTR:SI PNP	80131	2N2904A
A2Q7	1853-0012		TSTR:SI PNP	80131	2N2904A
A2Q8	1853-0012		TSTR:SI PNP	80131	2N2904A
A2Q9	1854-0039	1	TSTR:SI NPN	80131	2N3053
A2Q10	1853-0020	4	TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A2Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A2R1	0698-3260	4	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A2R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R3	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A2R4	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R5	2100-1774		R:VAR WW 2K OHM 5% TYPE H 1W	28480	2100-1774
A2R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R7	0698-0083	1	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A2R8	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R9	0757-0465	4	R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A2R10	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R11	0757-0466	1	R:FXD MET FLM 110K OHM 1% 1/8W	28480	0757-0466
A2R12	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A2R13	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A2R14	0764-0016	1	R:FXD MET FLM 1000 OHM 5% 2W	28480	0764-0016
A2R15	1810-0037	1	RESISTOR ARRAY:1K OHM 2% 1W EACH	28480	1810-0037
A2R16	0698-3136	2	R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A2R17	0698-3156	1	R:FXD MET FLM 14.7K OHM 1% 1/8W	28480	0698-3156
A2R18	0698-3260		R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A2R19	0698-3637	1	R:FXD MET OX 820 OHM 5% 2W	28480	0698-3637
A2R20	2100-1767	2	R:VAR WW 10 OHM 5% TYPE H 1W	28480	2100-1767
A2R21	2100-1767		R:VAR WW 10 OHM 5% TYPE H 1W	28480	2100-1767
A2R22	0698-3241	1	R:FXD FLM 250 OHM 0.25% 1/8W	28480	0698-3241
A2R23	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A2R24	0764-0033	1	R:FXD MET OX 33 OHM 5% 2W	28480	0764-0033
A2R25	0757-0279	1	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A2R26	0757-0439	1	R:FXD MET FLM 6.81K OHM 1% 1/8W	28480	0757-0439
A2R27	0698-3136		R:FXD MET FLM 17.8K OHM 1% 1/8W	28480	0698-3136
A2R28	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A2R29	0683-0275	2	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A2TP1	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP2	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP3	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP4	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP5	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP6	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2TP7	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A2U1	1820-0196	1	IC:LINEAR VOLTAGE REGULATOR(INPUT)	28480	1820-0196
A2U2	1826-0013		IC:LINEAR	28480	1826-0013
A2U3	1826-0013		IC:LINEAR	28480	1826-0013
A2VR1	1902-0025	2	DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A2VR2	1902-3245	2	DIODE BREAKDOWN:SILICON 21.5V 5%	28480	1902-3245
A2VR3	1902-3245		DIODE BREAKDOWN:SILICON 21.5V 5%	28480	1902-3245
A2VR4	1902-0025		DIODE,BREAKDOWN:10.0V 5% 400 MW	28480	1902-0025
A2VR5	1902-3256	1	DIODE:BREAKDOWN SILICON 23.7V 5%	28480	1902-3256
A2VR6	1902-3279	2	DIODE BREAKDOWN:28.7V	28480	1902-3279
A2VR7	1902-3048	1	DIODE BREAKDOWN:SILICON 3.48V 5%	28480	1902-3048
A2VR8	1902-3268	2	DIODE BREAKDOWN:26.1V 5%	28480	1902-3268
A2VR9	1902-3268		DIODE BREAKDOWN:26.1V 5%	28480	1902-3268
A3	08445-60103	1	YIG DRIVER ASSY	28480	08445-60103
A3C1	0160-3094	1	C:FXD CER 0.1 UF 10% 100VDCW	56289	2C18A1-CML
A3C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A3C3	0160-3455	1	C:FXD CER 470 PF 10% 1000VDCW	56289	C067F102F471KS22
A3CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A3CR2	1901-0040		DIODE:SILICON 50 MA 30 WV	07263	FDG1088

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A3F1	2110-0094	1	FUSE:1.25 AMP 250V	75915	3121.25
A3K1	0490-0894	1	RELAY:2 FORM C 2 AMP 30VDC	77342	HP11D
A3MP1	0340-0162	2	INSULATOR:TSTR FOR TO-66	13103	A0340-0162-1
A3MP2	1200-0043	2	INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
A3MP3	1200-0081	2	INSULATOR:BUSHING, NYLON	26365	974 307
A3MP4	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A3MP5	08445-00003	1	HEAT SINK:DRIVER	28480	08445-00003
A3Q1	1854-0022		TSTR:SI NPN	07263	S17843
A3Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q3	1854-0237	1	TSTR:SI NPN	80131	2N3738
A3Q4	1854-0217	1	TSTR:SI NPN	80131	2N3442
A3Q5	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q6	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A3Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A3Q8	1854-0072		TSTR:SI NPN	80131	2N3054
A3R1	0698-3150	1	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A3R2	0757-0317	1	R:FXD MET FLM 1.33K OHM 1% 1/8W	28480	0757-0317
A3R3	0757-0460	2	R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A3R4	0757-0460		R:FXD MET FLM 61.9K OHM 1% 1/8W	28480	0757-0460
A3R5	0698-3161	1	R:FXD MET FLM 38.3K OHM 1% 1/8W	28480	0698-3161
A3R6 ※	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R7	2100-1776		R:VAR WW 10K OHM 5% TYPE H 1W	28480	2100-1776
A3R8	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A3R9	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A3R10	0757-0422	1	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A3R11	0811-1362	1	R:FXD WW 1000 OHM 0.01% 1/4W	28480	0811-1362
A3R12	0811-3243	1	R:FXD WW 2.675 OHM 0.1% 2.5W	28480	0811-3243
A3R13 ※	0757-0398	1	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A3R14	0698-3160		R:FXD MET FLM 31.6K OHM 1% 1/8W	28480	0698-3160
A3R15	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A3R16	0811-3007		R:FXD WW 10K OHM 0.01% 1/32W	28480	0811-3007
A3R17	0757-0465		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0465
A3R18	0698-3441	1	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A3R19	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A3R20	0698-3449	1	R:FXD MET FLM 28.7K OHM 1% 1/8W	28480	0698-3449
A3R21	2100-1772	1	R:VAR WW 500 OHM 5% TYPE H 1W	28480	2100-1772
A3R22	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A3R23	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A3R24	2100-1777	2	R:VAR WW 20K OHM 5% TYPE H 1W	28480	2100-1777
A3R25 - R28			NOT ASSIGNED		
A3R29	2100-1777		R:VAR WW 20K OHM 5% TYPE H 1W	28480	2100-1777
A3S1	3101-1162		SWITCH:SLIDE MINIATURE, SPDT	79727	GF124-0008
A3TP1	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A3TP2	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A3TP3	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A3TP4	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A3U1	1826-0013		IC:LINEAR	28480	1826-0013
A3VR1	1902-0685	1	DIODE BREAKDOWN:9.0V 2%	04713	1N938
A3VR2	1902-3203	1	DIODE BREAKDOWN:SILICON 14.7V 5%	28480	1902-3203
A3VR3	1902-0184		DIODE BREAKDOWN:SILICON 16.2V 5%	28480	1902-0184
A3VR4	1902-3182	1	DIODE BREAKDOWN:SILICON 12.1V 5%	28480	1902-3182
A3VR5	1902-0175	1	DIODE BREAKDOWN:100V	28480	1902-0175
A3VR6	1902-3279		DIODE BREAKDOWN:28.7V	28480	1902-3279
A4	0960-0358	1	YIG FILTER	28480	0960-0358
A5	08445-60104	1	MOTHER BOARD ASSY	28480	08445-60104
A5R1	0698-3453	1	R:FXD MET FLM 196K OHM 1% 1/8W	28480	0698-3453
A5XA1	1251-1886	3	CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A5XA2	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A5XA3	1251-1886		CONN:PC 30-CONTACT (2X15)	71785	252-15-30-340
A6	5060-9409	1	POWER MODULE ASSEMBLY	28480	5060-9409
A6J1 THRU J8	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
			※ FACTORY SELECTED PART		

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	08445-60107	1	DIGITAL PANEL METER ASSY (FOR OPTION 003)	28480	08445-60107
A7J1	1251-0143	1	CONNECTOR:FEMALE 14-CONTACT JAC<	28480	1251-0143
A7MP1	0340-0037	3	POST:TERMINAL	28480	0340-0037
A7MP2	0340-0039	3	INSULATOR:BUSHING	28480	0340-0039
A7MP3	0340-0783	2	INSULATOR:SPRING	00000	OBD
A7MP4	0360-0016	1	TERMINAL:LUG	78452	718
A7MP5	0362-0192	6	TERMINAL:CRIMP LUG	00000	OBD
A7MP6	0403-0026	1	GLIDE:NYLON	28480	0403-0026
A7MP7	0520-0129	2	SCREW:PAN HD POZI DR 2-56 X 0.312" LG	00000	OBD
A7MP8	1200-0043		INSULATOR:TSTR MOUNTING(TO-3)	71785	293011
A7MP9	1200-0063	2	LUG:CRIMP	28480	1200-0063
A7MP10	2190-0003	2	WASHER:LOCK FOR #4 HWD	28480	2190-0003
A7MP11	2190-0014	2	WASHER:LOCK FOR #2 HWD	28480	2190-0014
A7MP12	2200-0103	2	SCREW:SST PHH POZI DR 4-40 X 1/4"W/LK	00000	OBD
A7MP13	2200-0143	2	SCREW:PAN HD POZI DR 4-40 X 0.375"	00000	OBD
A7MP14	2260-0001	2	NUT:HEX SSTL 4-40X1/4X3/32	80120	OBD#
A7MP15	3050-0026	2	WASHER:FLAT 0.125" ID	00000	OBD
A7MP16	08445-00110	1	MOUNTING BRACKET	28480	08445-00110
A7R1	0811-0569	1	R:FXD WW 1.1421K OHM 0.01% 0.125W	28480	0811-0569
A7R2	0811-1185	1	R:FXD WW 10.0K OHM 0.01% 1/20W	28480	0811-1185
A7U1	1820-0430	1	IC:LINEAR, VOLTAGE REGULATOR 5V	28480	1820-0430
A7A1					
A7A1					
A7A1	08445-60113	1	DIGITAL PANEL METER	28480	08445-60113
A7A1					
A7A1A1			(SEE A1 ASSY IN 34740A(DPM)MANUAL)		
A7A1A2			(SEE A2 ASSY IN 34740A(DPM)MANUAL)		
A7A1A3			(SEE A3 ASSY IN 34740A(DPM)MANUAL)		
A7A2	08445-60106	1	BOARD ASSY:JUMPER	28480	08445-60106
			CHASSIS PARTS		
B1	3160-0209	1	FAN:TUBE-AXIAL 115V/60HZ	28480	3160-0209
C1	0160-3451	2	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
C2	0160-3451		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
DS1	2140-0244	1	LAMP:GLOW MINIATURE 95V (PART OF S1)	87034	A1H
F1	2110-0001	1	FUSE:1 AMP 250V (FOR 100/120 VAC)	75915	312001.
F1	2110-0012		FUSE:0.5 AMP 250V (FOR 220/240 VAC)	75915	312.500
FL1	0960-0159	1	FILTER:LOW PASS 0-1.8 GHZ (DELETE FOR OPTION 004)	28480	0960-0159
J1	1250-0914	2	BODY:RF CONNECTOR	02660	131-150
J1	1250-0909	2	ASSY:RF CONNECTOR APC-7 TYPE (OPTION 001)	02660	131-1057
J1	1250-0915	2	CONTACT:RF CONNECTOR	02660	131-149
J1	1250-0816	2	CONTACT:RF CONNECTOR FOR APC-7 CONNECT (OPTION 001)	02660	131-1054
J1			(ALSO SEE MP30 THROUGH MP35).		
J2	1250-0914		BODY:RF CONNECTOR	02660	131-150
J2	1250-0909		ASSY:RF CONNECTOR APC-7 TYPE (OPTION 001)	02660	131-1057
J2	1250-0915		CONTACT:RF CONNECTOR	02660	131-149
J2	1250-0816		CONTACT:RF CONNECTOR FOR APC-7 CONNECT (OPTION 001)	02660	131-1054
J2			(ALSO SEE MP30 THROUGH MP35).		
J3	1250-0118	1	CONNECTOR:BNC (SEE MP8)	24931	28JR 128-1
J4	1251-2214	2	CONNECTOR:R & P 12 MALE CONTACTS (SEE MP18).	71785	DCM17W5P
K1	08445-60011	2	SWITCH:PRECISION, COAXIAL (DELETE FOR OPTION 004)	28480	08445-60011
K2	08445-60011		SWITCH:PRECISION, COAXIAL (DELETE FOR OPTION 004)	28480	08445-60011
MP1	0590-0127	2	NUT:SHEET METAL 4-40 THREAD	78553	C991-440-24B
MP2	1251-0218	2	CONNECTOR:LOCK POST SUBMINAT TYPE D	71468	D53018
MP3	2190-0016	1	WASHER:LOCK PH BRZ NP	00000	OBD

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP4	2200-0764	1	SCREW:FIL HD 4-40 X 0.156" LG	00000	OBD
MP5	2950-0001	1	NUT:HEX BRS NP 3/8-32 X 1/2	73734	9002
MP6	3150-0224	1	FILTER:AIR	28480	3150-0224
MP7	9223-0042	1	POST:POLYETHYLENE	28480	9223-0042
MP8	5040-0345	2	INSULATOR:CONNECTOR (USED WITH J4)	28480	5040-0345
MP9	5060-8543	1	BRACKET:JOINING KIT, OLIVE GRAY	28480	5060-8543
MP10	5060-8739	1	KIT:RACK MOUNT 3H	28480	5060-8739
MP11	08445-00008	4	CLAMP:FRONT PANEL TRIM	28480	08445-00008
MP12	08445-00021	1	BAFFLE:AIR	28480	08445-00021
MP13	08445-00105	1	SUB-PANEL:FRONT	28480	08445-00105
MP14	08445-00107	1	BRACKET:POT MOUNTING	28480	08445-00107
MP15	08445-00109	1	DECK:MAIN	28480	08445-00109
MP16	08445-20004	1	KNOB:KNURLED	28480	08445-20004
MP17	08445-40102	1	WINDOW COUNTER	28480	08445-40102
MP18	1251-0179	2	CONNECTOR:COAXIAL (USED WITH J5)	71468	DM-53740-5001
MP19	2200-0109	2	SCREW:PAN HD POZI DR 4-40 X 0.438" LG (USED WITH P1)	00000	OBD
MP20	5040-0327	1	HOOD:CONNECTOR (USED WITH P1)	28480	5040-0327
MP21	5040-0051	1	HOOD:CONNECTOR (USED WITH XA5)	28480	5040-0051
MP22	1251-0582	1	STRAIN RELIEF (USED WITH P2)	28480	1251-0582
MP23	08445-00004	1	KNOB:DIAL COARSE TUNE (FOR OPTION 002)	28480	08445-00004
MP24	08445-00005	1	KNOB:DIAL FINE TUNE (FOR OPTION 002)	28480	08445-00005
MP25	08445-00010	1	KNOB:DIAL MODE (FOR OPT 002 ONLY, DELETE FOR 004)	28480	08445-00010
MP25	08445-00006	1	KNOB:DIAL MODE (FOR OPT 002 & 004 COMBINED)	28480	08445-00006
MP26	08445-00111	1	SUPPORT:DIGITAL DISPLAY(FOR OPT 003)	28480	08445-00111
MP27	08445-00001	2	BRACKET MOUNTING, BOTTOM (DELETE FOR OPTION 004)	28480	08445-00001
MP28	08445-00002	2	BRACKET MOUNTING, TOP (DELETE FOR OPTION 004)	28480	08445-00002
MP29	0590-0923	1	NUT:KNURLED 1/2-32 THREAD (PART OF S1)	00000	OBD
MP30	5040-0306	1	INSULATOR (USED WITH J1 AND J2)	28480	5040-0306
MP31	08555-20093	1	CENTER CONDUCTOR (USED WITH J1 AND J2).	28480	08555-20093
MP32	08555-20094	1	BODY:BULKHEAD (USED WITH J1 AND J2).	28480	08555-20094
MP33	2190-0104	1	WASHER:LOCK 0.439" ID (USED WITH J1 AND J2).	00000	OBD
MP34	2950-0132	1	NUT:HEX 7/16-28 (USED WITH J1 AND J2).	00000	OBD
MP35	08761-2027	1	INSULATOR (USED WITH J1 AND J2)	28480	08761-2027
P1	1251-0158	1	CONNECTOR:PC (1 X 6) 6RIBBON CONTACT (SEE MP19, MP20) (PART OF W10, P1 THROUGH P8)	76530	250-06-30-210
P2	1251-0142	1	CONNECTOR:MALE 14 CONTACTS (SEE MP22: FOR OPT 003)	28480	1251-0142
P3 THRU P10	0362-0063	8	TERMINATION:CRIMP LUG FOR 0.046SO PIN	03000	OBD
R1	2100-3105	2	R:VAR COMP 100 OHM 10% LIN 1/2W	28480	2100-3105
R2	2100-3105		R:VAR COMP 100 OHM 10% LIN 1/2W	28480	2100-3105
R3	0757-0459	1	R:FXD MET FLM 56.2K OHM 1% 1/8W (PART OF W10)	28480	0757-0459
R4	2100-3128	2	R:VAR WW 10K OHM 10% LIN 2W (FOR OPTION 002)	28480	2100-3128
R5	2100-3128		R:VAR WW 10K OHM 10% LIN 2W (FOR OPTION 002)	28480	2100-3128
S1	3101-1395	1	SWITCH:PUSHBUTTON DPDT-DB (INCL DS1, MP29 ; P/O W10)	76854	53-67280-121/A1H
S2	3100-3229	1	SWITCH:ROTARY (FOR OPTION 002)		

See introduction to this section for ordering information

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
T1	9100-0545	1	TRANSFORMER:POWER	28480	9100-0545
TB1	0360-1190	1	LUG:SOLDER B.N.C.	79963	720 SPEC
W1	11670L	1	CABLE ASSY:RF RIGID(STANDARD) (DELETE FOR OPT 001)	28480	11670L
W1	11670M	1	CABLE ASSY:APC-7 CONNECTOR (FOR OPTION 001)	28480	11670M
W2	8120-1378	1	CABLE ASSY:AC POWER CORD	70903	KH-7081
W3	08445-60007	1	CABLE ASSY:INTERCONNECT	28480	08445-60007
W4	08445-20110	2	CABLE ASSY:SWITCH INPUT (DELETE FOR OPTION 004)	28480	08445-20110
W5	08445-20110		CABLE ASSY:SWITCH INPUT (DELETE FOR OPT 004)	28480	08445-20110
W6	08445-20111	1	CABLE ASSY:SWITCH-LP (DELETE FOR OPT 004)	28480	08445-20111
W7	08445-20112	1	CABLE ASSY:LP-SWITCH (DELETE FOR OPTION 004)	28480	08445-20112
W8	08445-20108	1	CABLE ASSY:YIG INPUT	28480	08445-20108
W9	08445-20109	1	CABLE ASSY:YIG OUTPUT	28480	08445-20109
W10	08445-60108	1	PRIMARY POWER WIRING HARNESS (INCL A6, P1-P8, R3 & S1)	28480	08445-60108
XA5	1251-0135	1	CONNECTOR:PC EDGE 15 CONTACT (SEE MP21)	95354	91-6915-1500-00

Table 6-2. Replaceable Parts

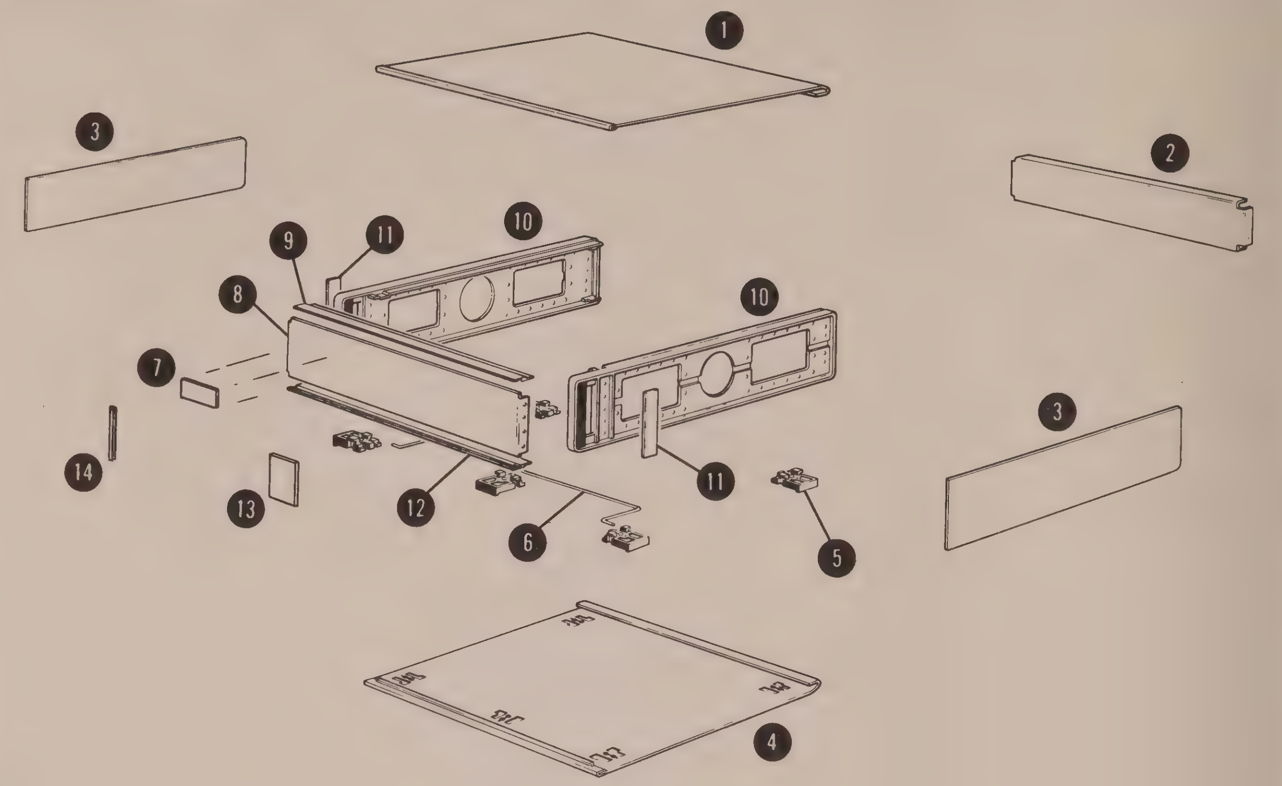


Figure 6-1. Cabinet Parts

Ref. Desig.	HP Part No.	Qty.	Description	Mfr. Code	Mfr. Part No.
❶	08445-00026	1	TOP COVER ASSY: MOD	28480	08445-00026
❷	08445-00108	1	PANEL: REAR	28480	08445-00108
❸	5000-8595	2	COVER:SIDE, OLIVE GRAY	28480	5000-8595
❹	08445-00027	1	BOTTOM COVER ASSY: MOD	28480	08445-00027
❺	5060-0767	5	FOOT ASSY: FM	28480	5060-0767
❻	1490-0030	1	STAND: TILT	28480	1490-0030
❼	08445-40101	1	WINDOW: LED (FOR OPT. 003 ONLY)	28480	08445-40101
❽	08445-00104	1	PANEL: FRONT (DELETE FOR OPT. 002 OR 003)	28480	08445-00104
❽	08445-00102	1	PANEL: FRONT (FOR OPT. 002 ONLY)	28480	08445-00102
❽	08445-00103	1	PANEL: FRONT (FOR OPT. 003 ONLY)	28480	08445-00103
❽	08445-00101	1	PANEL: FRONT (FOR OPT. 002 & 003 COMBINED)	28480	08445-00101
❾	5020-6850	1	TRIM: PANEL, MINT GRAY	28480	5020-6850
❿	5060-0730	1	FRAME ASSY: 3 X 16	28480	5060-0730
⓫	5000-0050	1	TRIM: SIDES	28480	5000-0050
⓬	5020-6851	1	TRIM: PANEL, MINT GRAY	28480	5020-6851
⓭	08445-00106	1	PLATE: CONNECTOR	28480	08445-00106
⓮	08443-40005	1	TRIM STRIP	28480	08443-40005

Table 6-3. Code List of Manufacturers

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	U.S.A. COMMON	ANY SUPPLIER OF U.S.A.	
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
04713	MOTOROLA SEMICONDUCTOR PROD.INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
13103	THERMALLOY CO.	DALLAS, TEX.	75247
24931	SPECIALTY CONNECTOR CO. INC.	INDIANAPOLIS, IND.	46227
26365	GRIES REPRODUCER CORP.	NEW ROCHELLE, N.Y.	10802
28480	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
70903	BELDEN CORP.	CHICAGO, ILL.	60644
71468	ITT CANNON ELECT. INC.	LOS ANGELES, CALIF.	90031
71785	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
73734	FEDERAL SCREW PROD. INC.	CHICAGO, ILL.	60618
75915	LITTELFUSE INC.	DES PLAINES, ILL.	60016
76530	CINCH MONADNOCK MILLS DIV. TRW INC.	CITY OF INDUSTRY, CALIF.	91746
76854	OAK MFG. CO. DIV. OAK ELECTRO/NETICS CORP.	CRYSTAL LAKE, ILL.	60014
77342	AMERICAN MACHINE & FOUNDRY CO. POTTER & BRUMFIELD DIV.	PRINCETON, IND.	47570
78452	THOMPSON-BREMER & CO.	CHICAGO, ILL.	60600
78553	TINNERMAN PROD. INC.	CLEVELAND, OHIO	44129
79727	CONTINENTAL-WIRT ELECTRONICS CORP.	WARMINSTER, PA.	18974
79963	ZIERICK MFG. CO.	MT. KISCO, N.Y.	10549
80120	SCHNITZER ALLOY PROD. CO.	ELIZABETH N.J.	07206
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON D.C.	20006
87034	MARCOAK INDUSTRIES	ANAHEIM, CALIF.	92803
91506	AUGAT INC.	ATTLEBORO, MASS.	02703
95354	METHODE MFG. CO.	ROLLING MEADOWS, ILL.	60008
98978	INTERNATIONAL ELECT. RESEARCH CORP.	BURBANK, CALIF.	91502

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. This section normally contains information for adapting this manual to instruments for which the content does not apply directly. Since this manual does apply directly to instruments having serial numbers listed on the title page, no change information is given here. Refer to INSTRUMENTS COVERED BY MANUAL in Section I for additional important information about serial number coverage.

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for troubleshooting and repair of the HP 8445B Automatic Preselector.

WARNING

> Line voltage is always present on terminals including the power input connector, fuse holder, power switch, etc. In addition, when the instrument is on, energy available at many points may result in personal injury or death when contacted.

8-3. PRINCIPLES OF OPERATION

8-4. Information relative to the principles of operation appears on the pages preceding Service Sheet 1.

8-5. RECOMMENDED TEST EQUIPMENT

8-6. Test equipment and accessories required to maintain the Preselector are listed in Table 1-4. If the equipment listed is not available, equipment that meets the required specifications may be substituted.

8-7. FACTORY SELECTED COMPONENTS

8-8. Some component values are selected at the time of final checkout at the factory. Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated components. These components, which are identified on the schematics with an asterisk, are listed in Table 8-1. The recommended procedure for replacing a factory-selected component is as follows:

a. Try the original value, then perform the test specified in Section V of this manual for the circuit being repaired.

Table 8-1. Factory Selected Components

Ref. Desig.	Selected For	Normal Value Range	Service Sheet
A3R6	Centering TRACKING control.	30-100Ω	4
A3R13	Optimum adjustment range for COURSE TRACKING control.	0-200Ω	4

b. If the specified test cannot be satisfactorily performed, try the typical value shown in the parts list and repeat the test.

c. If the test results are still not satisfactory, substitute various values until the desired result is obtained.

8-9. ADJUSTABLE COMPONENTS

8-10. Adjustable components, other than front panel operating controls, are listed in Table 8-2. Adjustment procedures for these components are contained in Section V of this manual.

8-11. REPAIR

8-12. Servicing aids on printed circuit boards include test points, transistor designations, adjustment callouts and assembly part numbers with alpha-numerical revision information. Table 8-3, Schematic Diagram Notes, provides information relative to symbols and values shown on schematic diagrams.

8-13. GENERAL SERVICE HINTS

8-14. Etched Circuit Boards

8-15. The etched circuit boards used in Hewlett-Packard equipment are the plated-through type consisting of metallic conductors bonded to both sides of an insulating material. The circuit boards can be either a single layer or multi-layer board. The metallic conductors are extended through the component holes or interconnect holes by a plating process. Soldering can be performed on either side of the board with equally good results. Table 8-4 lists recommended tools and materials for use in repairing etched circuit boards. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

Table 8-2. Adjustable Components

Designation	Circuit	Purpose
A1R34/*R38*	Harmonic Number Amplifier	Amplifier null
A1R42/*R46*	n= + or — Amplifier	Amplifier null
A1R37/*R41*	IF = 550 MHz/2.05 GHz Network	2050 MHz IF Offset
A1R36/*R40*	IF = 550 MHz/2.05 GHz Network	550 MHz IF Offset
A1R35/*R39*	Summing Amplifier	Amplifier null
A2R5	Power Supply	+19.5 Vdc Adjust
A2R20	Remote Control Amplifier	Common Differential Mode null
A2R21	Remote Control Amplifier	Common Differential Mode null
A2R23	Remote Control Amplifier	Amplifier null
A3R7	YIG Driver	Amplifier null/FREQ OFFSET control centering
A3R29	YIG Driver	18 GHz Breakpoint
A3R24	YIG Driver	15.5 GHz Breakpoint

NOTE: Items in italics are part of Option 003 instruments.

c. Use a suction device or wooden toothpick to remove solder from component mounting holes.

CAUTION

Do not use a sharp metal object such as an awl or twist drill for this purpose. Sharp objects may damage the plated-through conductor.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion.

8-16. Component Replacement

8-17. The following procedures are recommended when component replacement is necessary:

a. Remove defective component from board.

b. If component was unsoldered, remove solder from mounting holes with a suction device or a wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes and position component as original was positioned. Do not force leads into mounting holes: sharp lead ends may damage the plated-through conductor.

NOTE

Although not recommended when both sides of the circuit board are accessible, axial lead componennts such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection and clip off excess lead.

8-18. GENERAL SERVICE INFORMATION

8-19. Transistors and Diodes

8-20. Transistors and diodes are used throughout the Preselector in circuit configurations such as delay circuits, trigger circuits, switches, oscillators and various types of amplifiers. Basic transistor operation is shown in the following pages.

8-21. Transistor In-Circuit Testing. The common causes of transistor failure are internal short circuits and open circuits. In transistor circuit testing, the most important consideration is the transistor base-to-emitter junction. The base emitter junction in a transistor is comparable to the control grid-cathode relationship in a vacuum tube. The base emitter junction is essentially a solid-state diode; for the transistor to conduct, this diode must be forward biased. As with simple diodes, the

Table 8-3. Schematic Diagram Notes

SCHEMATIC DIAGRAM NOTES

Refer to ANSI Y32.2

Resistance is in ohms, capacitance is in microfarads, and inductance in millihenries unless otherwise noted.

P/O = part of.

*Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

⊘	Screwdriver adjustment .	○	Panel control.
▭	Encloses front panel designation.	⬚	Encloses rear panel designation.

—— - - ——	Circuit assembly borderline.
— — — — —	Other assembly borderline.
━━►━━	Heavy line with arrows indicates path and direction of main signal.
━ ━►━ ━	Heavy dashed line with arrows indicates path and direction of main feedback.
CW ⌇←	Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.
☆①	Numbers in stars on circuit assemblies show locations of test points.
⬭	Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe, e.g. (947) denotes white base, yellow wide stripe, viole= t narrow stripe.
n=1±*	n = harmonic number 1 = 1st LO fundamental ± = 1st LO above or below 1st IF * = 550 MHz 1st IF; no asterisk = 2050 MHz 1st IF.
Ⓐ 3	Letter = off page connection. Number = Service Sheet location for off page connection.

forward-bias polarity is determined by the materials forming the junction. Transistor symbols on schematic diagrams reveal the bias polarity required to forward-bias the base-emitter junction. The B part of Figure 8-1 shows transistor symbols with the terminals labeled. The other two columns compare the biasing required to cause conduction and cut-off in NPN and PNP transitors. If the transistor base-emitter junction is forward biased, the transistor conducts. However, if the base-emitter junction is reverse-biased, the transistor is cut off (open). The voltage drop across a forward-biased, emitter-base junction varies with transistor collector current. For example, a germanium transistor has a typical forward-bias, base-emitter voltage of 0.2—0.3 volt when collector current is 1—10 mA, and 0.4—0.5 volt when collector current is 10—100 mA. In contrast, forward-bias voltage for silicon transistors is about twice that for germanium types; about 0.5—0.6 volt when collector current is low, and about 0.8—0.9 volt when collector current is high.

8-22. Figure 8-1, Part A, shows simplified versions of the three basic transistor circuits and gives the characteristics of each. When examining a transistor stage, first determine if the emitter-base junction is biased for conduction (forward-biased) by measuring the voltage difference between emitter and base. When using an electronic voltmeter, do not measure directly between emitter and base; there may be sufficient loop current between the voltmeter leads to damage the transistor. Instead, measure each voltage separately with respect to a common point (e.g., chassis). If the emitter-base junction is forward-biased, check for amplifier action by short-circuiting base to emitter while observing collector voltage. The short circuit eliminates base-emitter bias and should cause the transistor to stop conducting (cut off). Collector voltage should then change and approach the supply voltage. Any difference is due to leakage current through the transistor and, in general, the smaller this current the better the transistor. If the collector voltage does not change, the transistor has either an emitter-collector short circuit or emitter-base open circuit.

8-23. Transistor and Diode Markings. Figure 8-2 illustrates examples of diode and transistor marking methods. In addition, the emitter lead for bipolar transistors is identified on the printed circuit boards.

Table 8-4. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47½—56½ Tip Temp: 850—900 degrees	Ungar No. 776 handle with *Ungar No. 4037 Heating Unit
Soldering* tip	Soldering Unsoldering	*Shape: pointed	*Ungar No. PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapult by Edsyn Co., Arleta, California
Resin (flux)	Remove excess flux from soldered area before application of protective coating.	Must not dissolve etched circuit base board material or conductor bonding agent	Freon, Aceton, Lacquer Thinner, Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective coating	Contamination, corrosion protection	Good electrical insulation, corrosion-prevention properties	Silicone Resin such as GE DRI-FILM** 88

*For working on etched boards; for general purpose work, use Ungar No. 1237 Heating Unit (37.5W, tip temperature of 750—800 degrees) and Ungar No. PL113, 1/8 inch chisel tip.

**General Electric Co., Silicone Products Dept., Waterford, New York, U.S.A.

8-24. Operational Amplifiers

8-25. Operational Amplifiers Function. Operational amplifiers are used to provide such functions as summing amplifiers, offset amplifiers, buffers and power supplies. The particular function is determiend by the external circuit connections. Equivalent circuit and logic diagrams for type 741 operational amplifiers are contained in Figure 8-3. Circuit A is a non-inverting buffer amplifier with a gain of 1. Circuit B is a non-inverting amplifier with gain determined by the resistance of R1 and R2. Circuit C is an inverting amplifier with gain determined by R1 and R2, with the input impedance determined by R2. Circuit D contains the functional circuitry and pin connection information along with an operational amplifier review.

NOTE

> In Circuit D it is assumed that the amplifier has high gain, low output impedance and high input impedance.

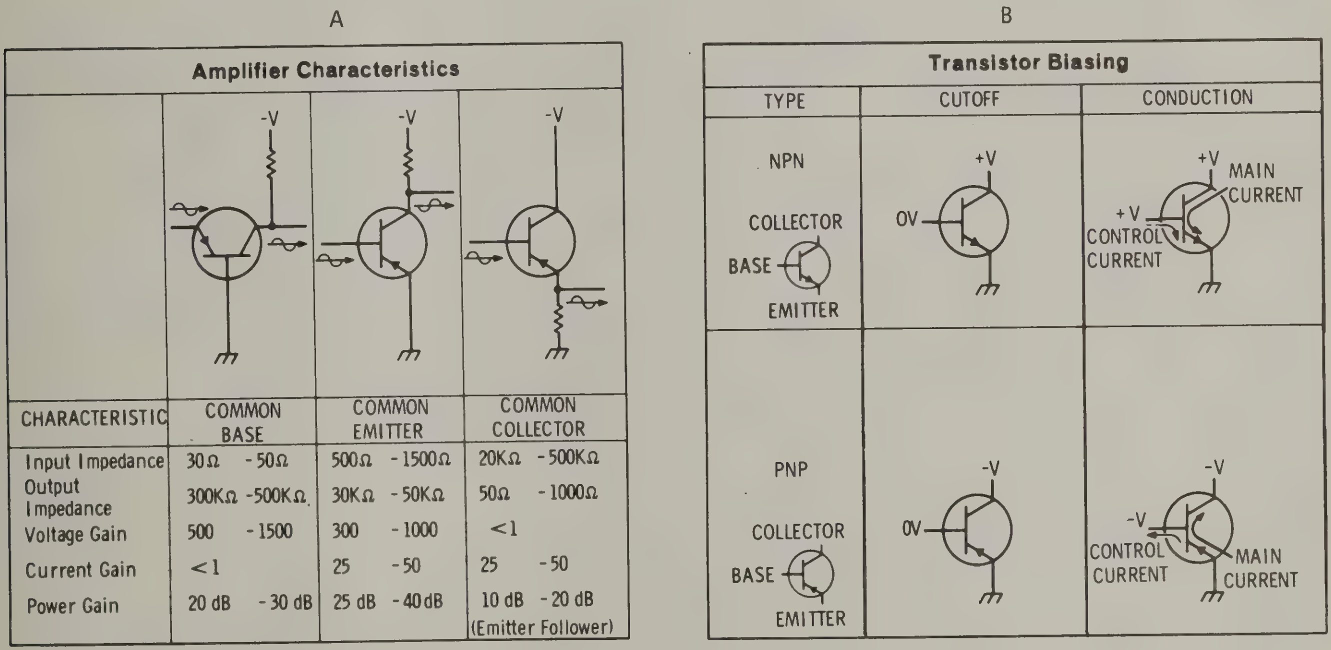
8-26. Operational Amplifier Troubleshooting Procedure. Measure and record the voltage level at both the —(inverting) terminal pin 2 and the + (non-inverting) terminal pin 3. The level should not differ by more than ≅ 10 mV. If the voltage level is not within ≅ 10 mV, check the external circuitry and components. If the external circuitry (input signal, operating voltages, feedback resistors) is normal, replace the operational amplifier.

8-27. ELECTRICAL MAINTENANCE

8-28. Perform the electrical checks and adjustments periodically and after repair or component replacement.

8-29. MECHANICAL MAINTENANCE

8-30. Inspect the air filter at the rear of the instrument frequently and clean it before air flow is restricted. To clean the filter, wash thoroughly in warm water and detergent. Air dry filter before installing it on the instrument.



A

Amplifier Characteristics

CHARACTERISTIC	COMMON BASE	COMMON EMITTER	COMMON COLLECTOR
Input Impedance	30Ω - 50Ω	500Ω - 1500Ω	20KΩ - 500KΩ
Output Impedance	300KΩ - 500KΩ	30KΩ - 50KΩ	50Ω - 1000Ω
Voltage Gain	500 - 1500	300 - 1000	<1
Current Gain	<1	25 - 50	25 - 50
Power Gain	20 dB - 30 dB	25 dB - 40 dB	10 dB - 20 dB (Emitter Follower)

Figure 8-1. Transistor Operation

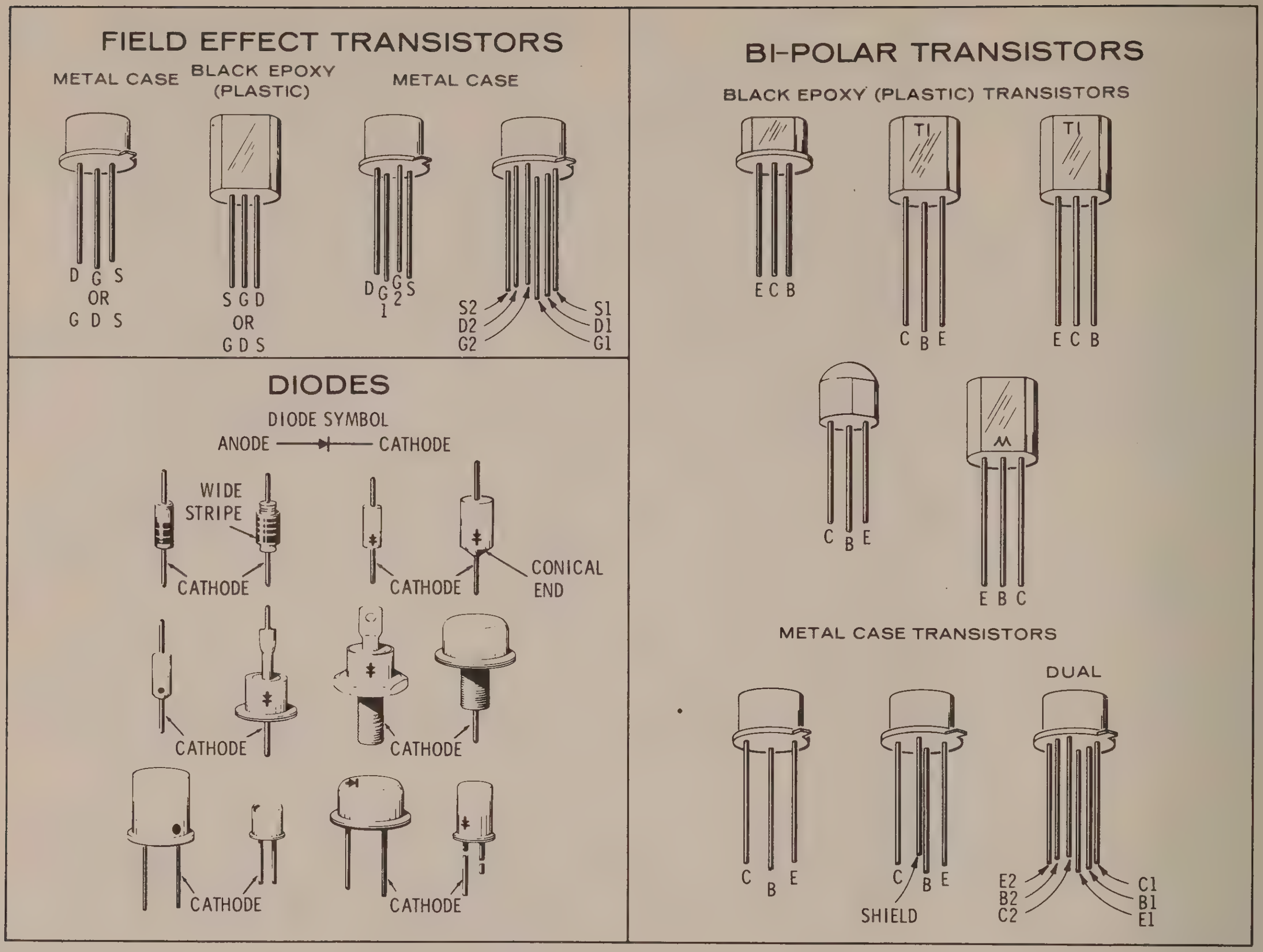
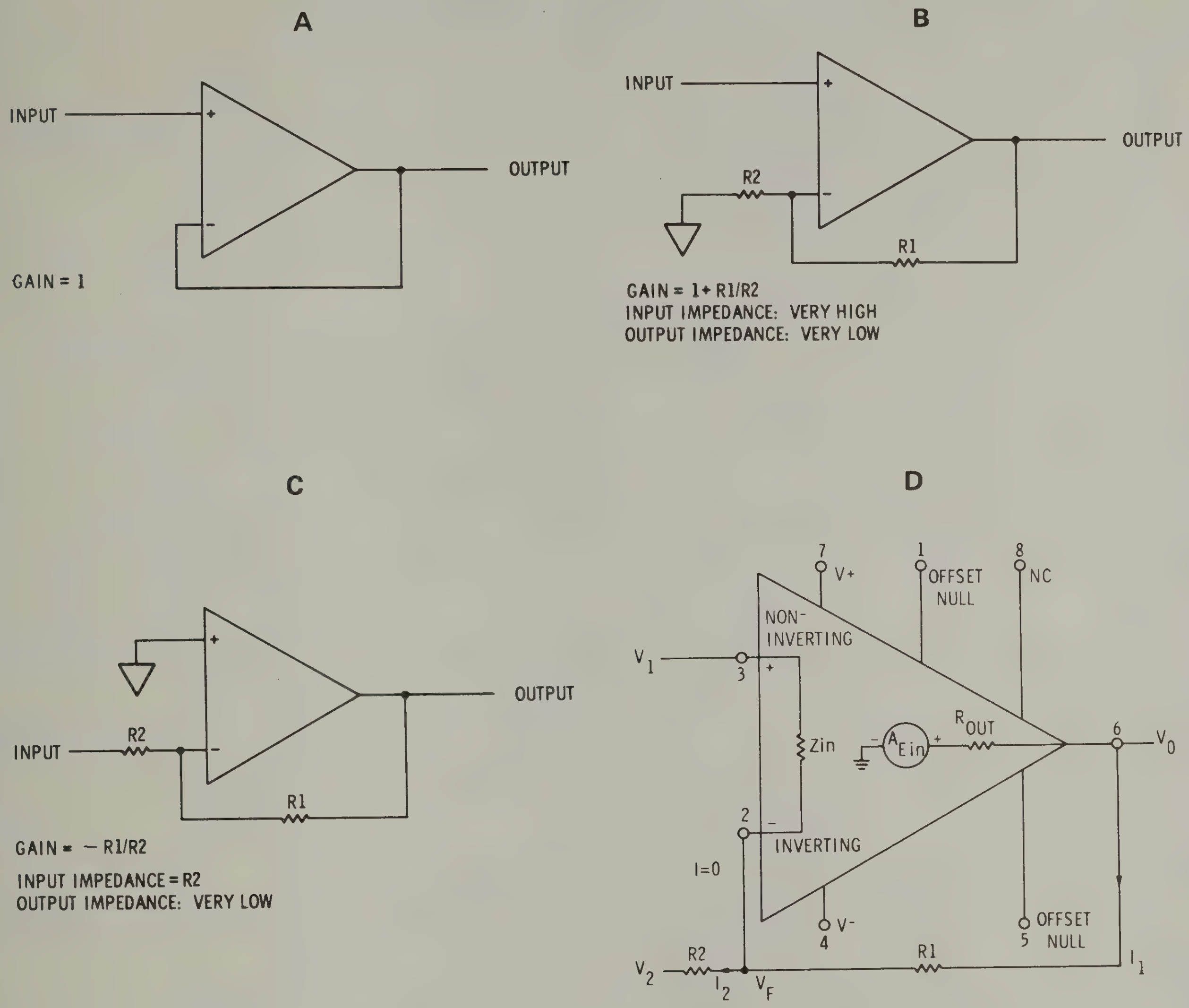


Figure 8-2. Examples of Diode and Transistor Marking Methods



IF "A" IS LARGE, $V_F = V_1$

(1) $\boxed{V_o = V_1 (1 + \frac{R1}{R2}) - V_2 (\frac{R1}{R2})}$

(2) IF $V_2 = 0$ (⏚), THEN $\boxed{V_0 = V_1 (1 + \frac{R1}{R2})}$

(3) IF $V_1 = 0$ (⏚), THEN $\boxed{V_0 = -V_2 (\frac{R1}{R2})}$

Figure 8-3. Operational Amplifier Equivalent Circuit

SERVICE SHEETS

GENERAL INFORMATION

The numerals in the lower corner of each block refer to Service Sheets following the block diagram. Service sheets for the Preselector are contained in the following format:

Block diagram — Service Sheet 1
Troubleshooting Block Diagram — Service Sheet 2
YIG Pre-Driver schematic — Service Sheet 3
DPM Pre-Driver schematic — Service Sheet 3A
YIG Driver schematic — Service Sheet 4
Switching, Manual and Remote Control — Service Sheet 5
Power Supplies — Service Sheet 6

BLOCK DIAGRAM DESCRIPTION (SERVICE SHEET 1)

Service Sheet 1 contains a functional block diagram of the Preselector. The Preselector is a Low-Pass Filter from dc to 1.8 GHz and a voltage tunable bandpass filter from 1.8 to 18 GHz. When used with the 8555A Spectrum Analyzer System (140/8552/8555A) selection of the Low-Pass Filter or the YIG Filter is automatic with control and tune voltages supplied by the Spectrum Analyzer. The Preselector can be used as a stand-alone bandpass filter. Tuning voltage supplied via the remote input determines the center frequency of the YIG filter. Instruments with manual controls may be tuned to any frequency within the filters range by the COARSE and FINE controls.

TROUBLESHOOTING BLOCK DIAGRAM (SERVICE SHEET 2)

Service Sheet 2 contains the block diagram and is used to isolate malfunction to the module level. The individual service sheets are used in isolating the malfunctioning component.

YIG PRE-DRIVER (SERVICE SHEET 3)

The YIG Pre-Driver uses input voltages from the 8555A Spectrum Analyzer System and produces an output voltage that is proportional to the frequency to which the analyzer is tuned. The analyzer provides a Sweep + Tune voltage that is representative of the frequency of the YIG oscillator in the analyzer. This voltage varies linearly from —5.000 volts for a LO frequency of 2.050 GHz to —10.000 volts for a LO frequency of 4.100 GHz. The Sweep + Tune voltage is applied to a harmonic number amplifier in the Preselector. The gain of the harmonic amplifier is controlled by Band Code signals “A” and “B” from the analyzer. Band Code bits “A” and “B” represent the frequency bands n=1 through n=4. The output from the harmonic number amplifier is a voltage representative of LO harmonic frequency. The frequency-to-voltage ratio is 1.025 GHz/Volt. The output from the harmonic amplifier is applied to a summing amplifier where it is combined with the IF offset voltage. Band Code bit “E” from the analyzer is applied the n= + or — mixing offset amplifier in the Preselector. The + or — mixing offset amplifier provides an offset voltage to match the mixing mode in the analyzer. The output from the offset amplifier is applied through a 2.05 GHz IF or 550 MHz IF offset network to the summing amplifier. The IF offset is a resistive network controlled by Band Code bit “D” from the analyzer. The output is a voltage proportional to the analyzer’s 1st IF offset. The frequency-to-voltage ratio is 1.025 GHz/Volt. The Summing Amplifier combines the output of the Harmonic Number Amplifier with the output from the 2.05 GHz/550 MHz IF Offset Network to produce an output voltage level to the YIG Driver that is proportional to the frequency to which the analyzer is tuned. The Summing Amplifier has unity gain (—1) with an output voltage level proportional to frequency by a ratio of 1.025 GHz/volt.

SERVICE SHEETS (cont'd)

DPM PRE-DRIVER, OPTION 003 ONLY (SERVICE SHEET 3A)

The DPM Pre-Driver output drives the Digital Panel Meter to provide a readout of the frequency to which the YIG Filter is tuned. In automatic mode the readout is the Spectrum Analyzer center frequency, therefore, only the TUNE voltage is input to the DPM Pre-Driver. Operation of the DPM Pre-Driver is exactly like the YIG Pre-Driver except that at frequencies of >18 GHz, the relay at the output is opened by Band Code "C" and the DPM readout is zero.

YIG DRIVER (SERVICE SHEET 4)

The input to the YIG Driver is a voltage proportional to frequency by a ratio of 1.025 GHz/volt. The YIG Driver output is a current that tunes the YIG Filter from 1.8 to 18 GHz. The input to the YIG Driver can be supplied from any one of three separate sources; the Yig Pre-Driver, the remote control circuitry, or the manual control circuitry. Switching is automatic except for instruments with manual controls. Refer to Service Sheet 5 for switching information. Two front panel controls are associated with the YIG Driver circuitry. FREQ OFFSET control corrects for a frequency offset of approximately 255 MHz in the YIG Filter linear current-frequency curve. The offset is due primarily to the residual magnetism in the core structure. TRACKING control corrects for minor variations in circuit component values chosen to give the desired coil current-input voltage relationship. Temperature compensation is provided by a thermistor installed in the YIG Filter with feedback applied to the YIG Driver input amplifier.

+9 Volt Reference

The YIG Driver Assembly A3 contains a +9 volt power supply. The +9 volt source is used as a reference by the Pre-Driver n= + or — Offset Amplifier A2U2.

MANUAL, REMOTE, AND SWITCHING CONTROL CIRCUITRY (SERVICE SHEET 5)

a. Manual Control Circuitry. Instruments with Option 002 are equipped with manual front panel tuning controls and a mode switch. COARSE and FINE tuning controls allow the YIG Filter to be manually tuned over the 1.8 to 18 GHz frequency range. The MODE switch provides manual selection of AUTO, REMOTE, MANUAL, or LOW-PASS (low-Pass Filter) operation. All instruments contain the manual control amplifier; located on the Power Supply Assembly A2. On instruments without manual controls, the input and output of the manual control amplifier is left floating.

b. Remote Control Circuitry. All instruments are equipped with provisions for remote tuning of the YIG Filter by an external voltage source. The REMOTE input, floating BNC connector on the rear panel, has a frequency tuning ratio of 1 GHz/volt. A remote control amplifier (located on the Power Supply Assembly A2) inverts and conditions the remote input voltage to drive the YIG Driver. On instruments with option 004, selection of the REMOTE input is accomplished with the MODE switch. Instruments other than option 004 (without manual controls) are automatically switched to REMOTE input when the associated Spectrum Analyzer is turned off or the interconnecting cable between the Preselector and Spectrum Analyzer is removed.

SERVICE SHEETS (cont'd)

c. Switch Control Circuitry. The switch control circuitry consists of the REMOTE switching (b, above) and the coaxial switching circuitry. The coaxial switching circuitry is controlled by Band Code signals from the 8555A Spectrum Analyzer RF Section. For instruments without manual controls and for instruments with manual controls set to AUTO position, Band Code signals determine the selection of the YIG Filter or Low-Pass Filter.

POWER SUPPLY ASSEMBLY (SERVICE SHEET 6)

Refer to Service Sheet 6 for the —23, +19.5 and +40 volt power supplies. In addition to the three supplies above, +9 volt and +28 volt supplies are required by the Preselector. The +9 volt reference supply and the +28 volt YIG heater supply are located on the YIG Driver Assembly A3 with the schematic diagram shown on Service Sheet 4.

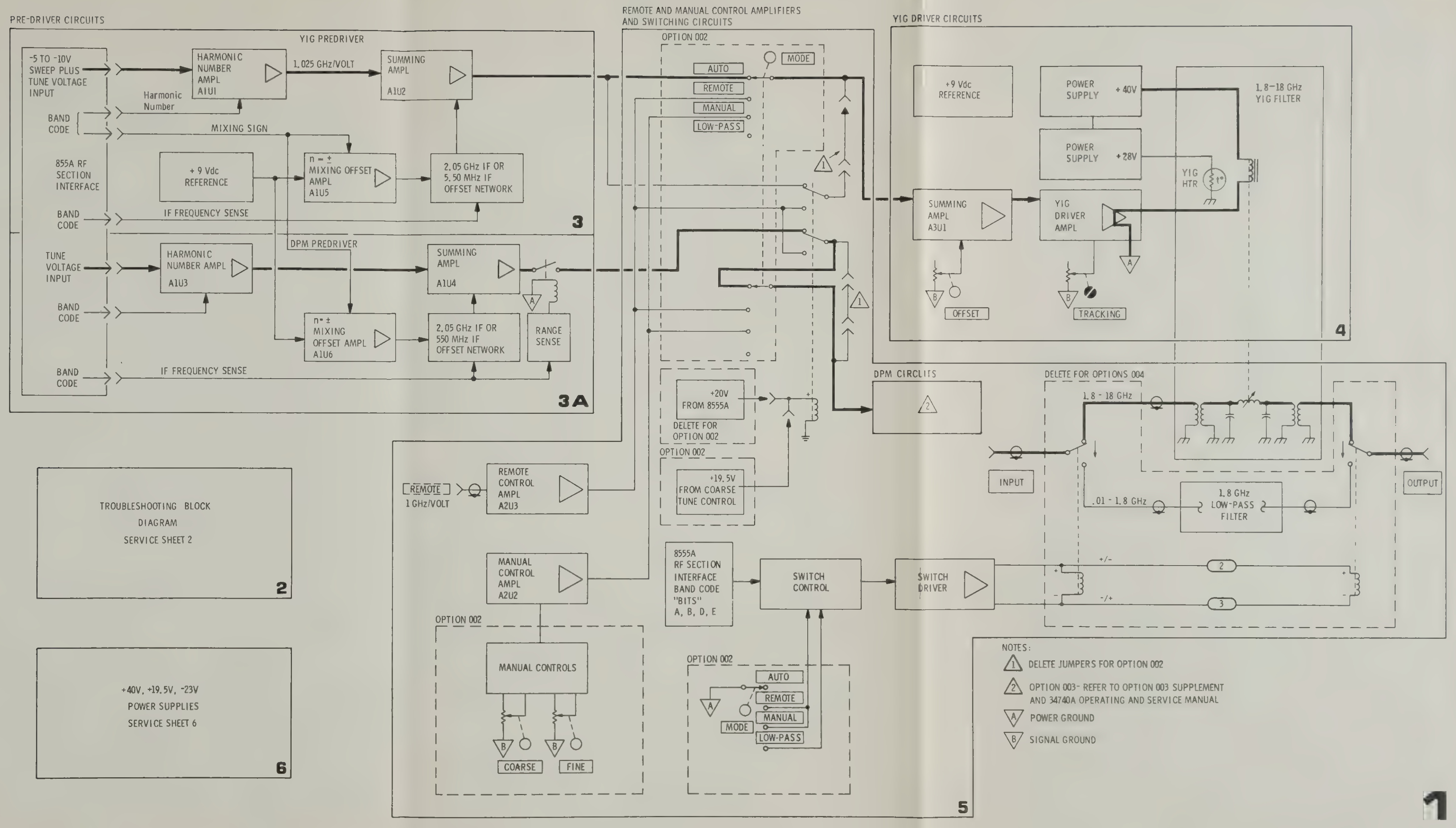
Preselector Simplified Block Diagram
◀ SERVICE SHEET 1

SERVICE SHEETS (cont'd)

c. Switch Control Circuitry. The switch control circuitry consists of the REMOTE switching (b, above) and the coaxial switching circuitry. The coaxial switching circuitry is controlled by Band Code signals from the 8555A Spectrum Analyzer RF Section. For instruments without manual controls and for instruments with manual controls set to AUTO position, Band Code signals determine the selection of the YIG Filter or Low-Pass Filter.

POWER SUPPLY ASSEMBLY (SERVICE SHEET 6)

Refer to Service Sheet 6 for the —23, +19.5 and +40 volt power supplies. In addition to the three supplies above, +9 volt and +28 volt supplies are required by the Preselector. The +9 volt reference supply and the +28 volt YIG heater supply are located on the YIG Driver Assembly A3 with the schematic diagram shown on Service Sheet 4.



NOTES:

1 DELETE JUMPERS FOR OPTION 002

2 OPTION 003- REFER TO OPTION 003 SUPPLEMENT AND 34740A OPERATING AND SERVICE MANUAL

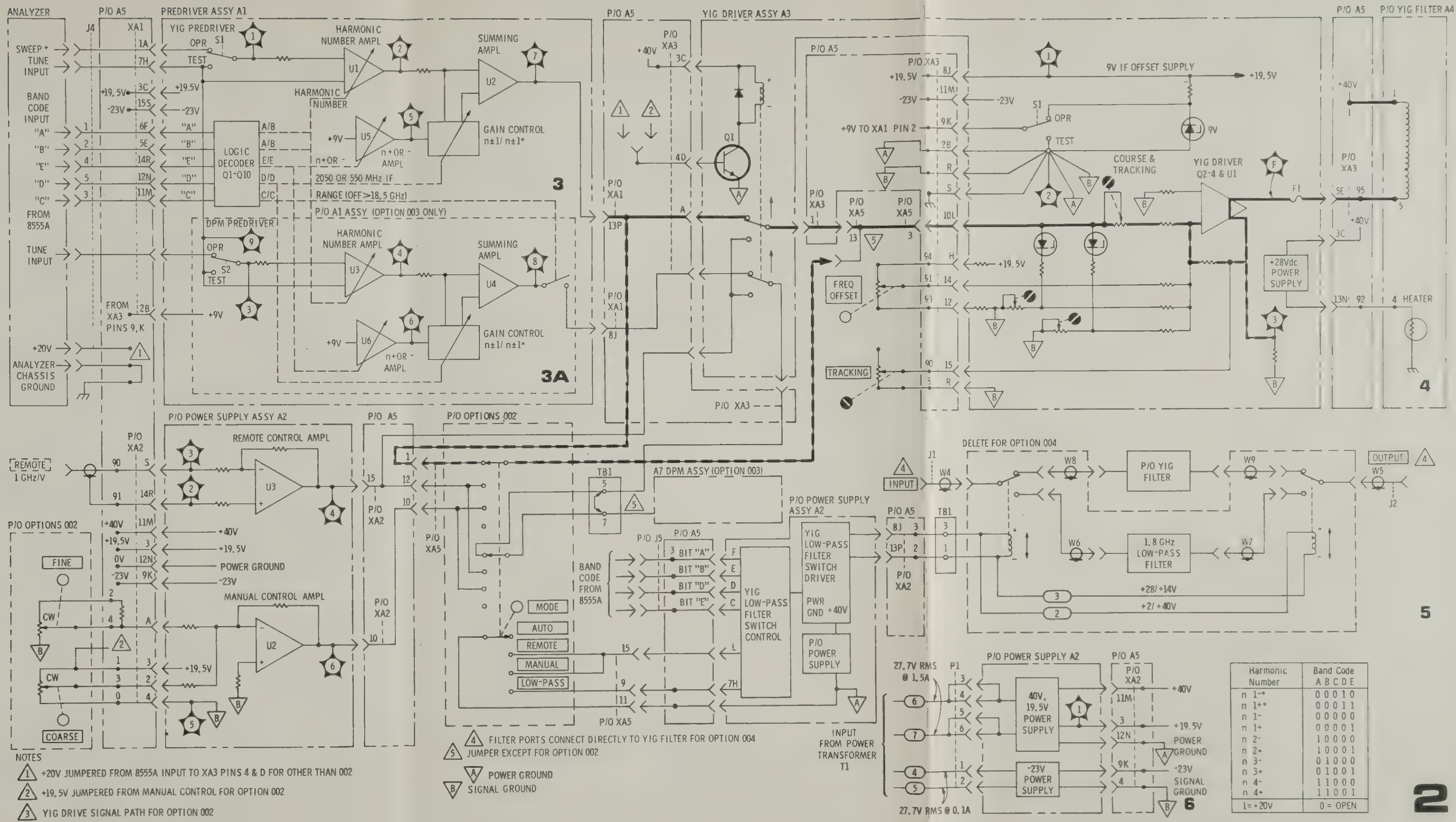
A POWER GROUND

B SIGNAL GROUND

Figure 8-4. Preselector Simplified Block Diagram

Preselector Troubleshooting Block Diagram
SERVICE SHEET 2

Preselector Simplified Block Diagram
◀ SERVICE SHEET 1



Harmonic Number	Band Code A B C D E
n 1-*	0 0 0 1 0
n 1+*	0 0 0 1 1
n 1-	0 0 0 0 0
n 1+	0 0 0 0 1
n 2-	1 0 0 0 0
n 2+	1 0 0 0 1
n 3-	0 1 0 0 0
n 3+	0 1 0 0 1
n 4-	1 1 0 0 0
n 4+	1 1 0 0 1
1= +20V	0 = OPEN

NOTES

1. +20V JUMPERED FROM 8555A INPUT TO XA3 PINS 4 & D FOR OTHER THAN 002
2. +19.5V JUMPERED FROM MANUAL CONTROL FOR OPTION 002
3. YIG DRIVE SIGNAL PATH FOR OPTION 002
4. FILTER PORTS CONNECT DIRECTLY TO YIG FILTER FOR OPTION 004
5. JUMPER EXCEPT FOR OPTION 002

A POWER GROUND

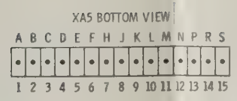
B SIGNAL GROUND

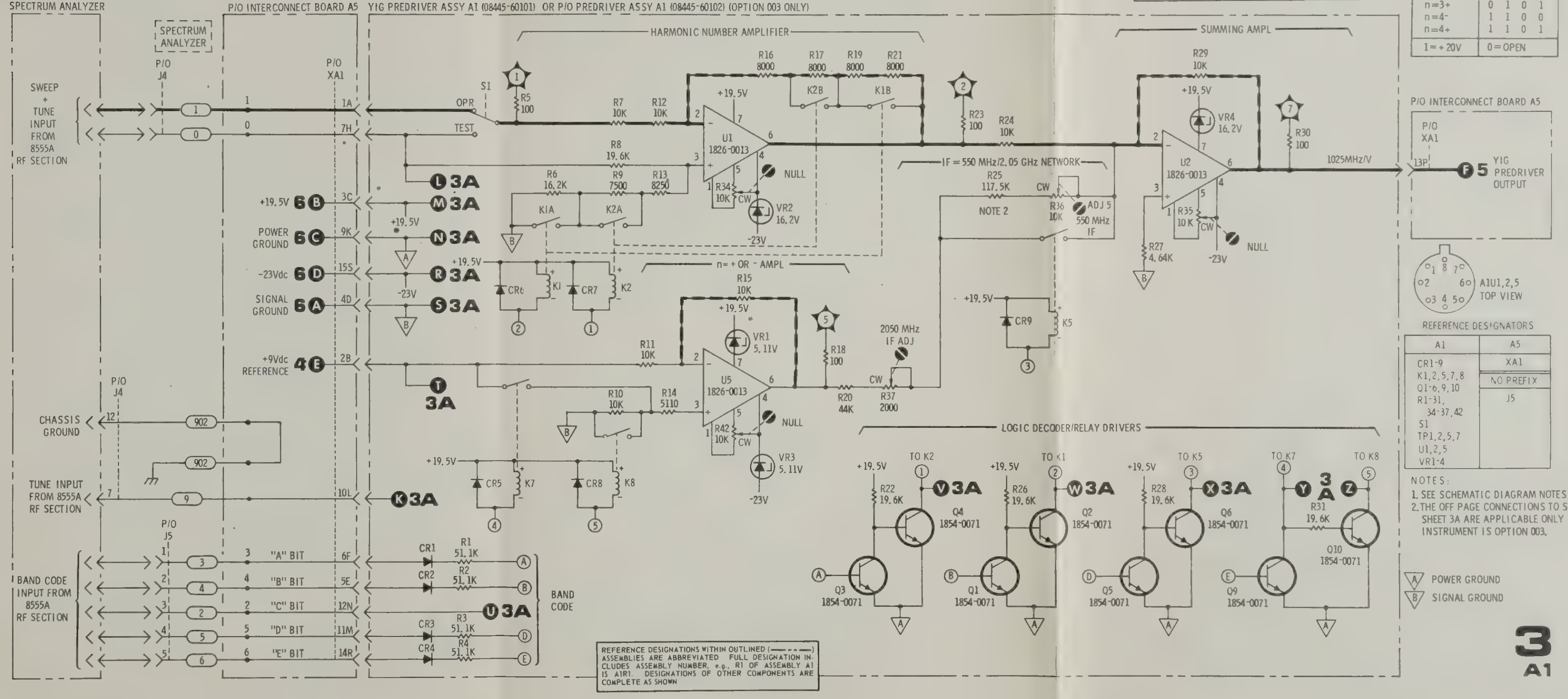
Figure 8-5. Preselector Troubleshooting Block Diagram

A1 YIG Predriver Assembly
◀ SERVICE SHEET 3

BAND	K2	K1	K5	K7	K8
n=1⁻*	ON	ON	OFF	OFF	ON
n=1⁺*	ON	ON	OFF	ON	OFF
n=1⁻	ON	ON	ON	OFF	ON
n=1⁺	ON	ON	ON	ON	OFF
n=2⁻	OFF	ON	ON	OFF	ON
n=2⁺	OFF	ON	ON	ON	OFF
n=3⁻	ON	OFF	ON	OFF	ON
n=3⁺	ON	OFF	ON	ON	OFF
n=4⁻	OFF	OFF	ON	OFF	ON
n=4⁺	OFF	OFF	ON	ON	OFF

HARMONIC NUMBER	BAND CODE A	B	D	E
n=1⁻*	0	0	1	0
n=1⁺*	0	0	1	1
n=1⁻	0	0	0	0
n=1⁺	0	0	0	1
n=2⁻	1	0	0	0
n=2⁺	1	0	0	1
n=3⁻	0	1	0	0
n=3⁺	0	1	0	1
n=4⁻	1	1	0	0
n=4⁺	1	1	0	1
1 = +20V	0 = OPEN			





REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED FULL DESIGNATION INCLUDES ASSEMBLY NUMBER, e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

REFERENCE DESIGNATORS

A1	A5
CR1-9 K1,2,5,7,8 Q1-6,9,10 R1-31, 34-37,42 S1 TP1,2,5,7 U1,2,5 VR1-4	XA1 NO PREFIX J5

NOTES:

1. SEE SCHEMATIC DIAGRAM NOTES, TABLE 8-3.
2. THE OFF PAGE CONNECTIONS TO SERVICE SHEET 3A ARE APPLICABLE ONLY IF THE INSTRUMENT IS OPTION 003.

3
A1

Figure 8-6. Yig Predriver Schematic Diagram

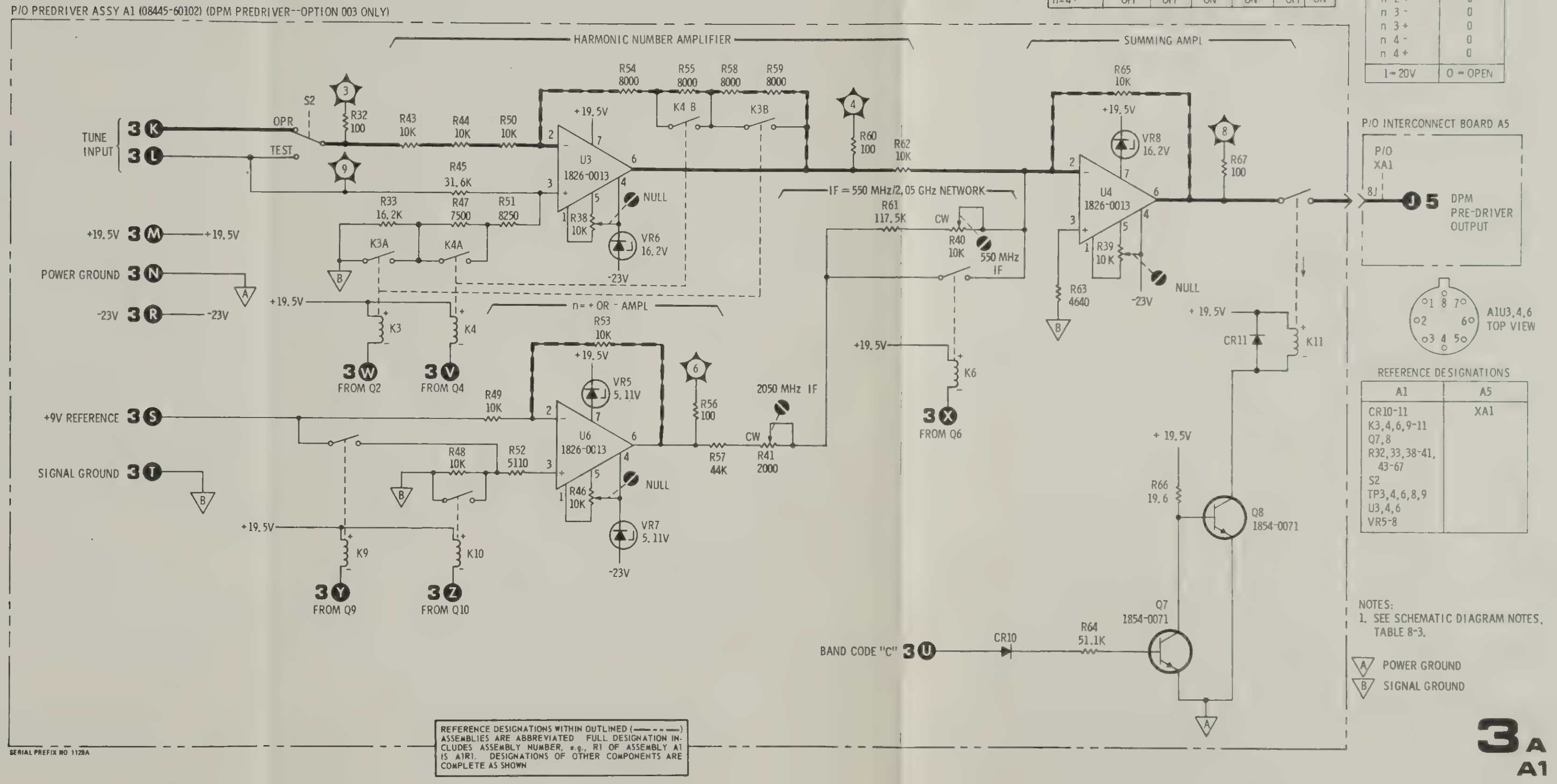
P/O A1 Predriver Assembly (Opt. 003 Instruments Only)

◀ SERVICE SHEET 3A

A1 YIG Predriver Assembly
◀ SERVICE SHEET 3

BAND	K4	K3	K6	K9	K10	K11
n=1-*	ON	ON	OFF	OFF	ON	ON
n=1+*	ON	ON	OFF	ON	OFF	ON
n=1-	ON	ON	ON	OFF	ON	ON
n=1+	ON	ON	ON	ON	OFF	ON
n=2-	OFF	ON	ON	OFF	ON	ON
n=2+	OFF	ON	ON	ON	OFF	ON
n=3-	ON	OFF	ON	OFF	ON	ON
n=3+	ON	OFF	ON	ON	OFF	ON
n=4-	OFF	OFF	ON	OFF	ON	ON
n=4+	OFF	OFF	ON	ON	OFF	ON

HARMONIC NUMBER	BAND CODE C
n 1 - *	0
n 1 + *	0
n 1 -	0
n 1 +	0
n 2 -	0
n 2 +	0
n 3 -	0
n 3 +	0
n 4 -	0
n 4 +	0
1 = 20V	0 = OPEN



REFERENCE DESIGNATIONS WITHIN OUTLINED (—— - - ——) ASSEMBLIES ARE ABBREVIATED FULL DESIGNATION INCLUDES ASSEMBLY NUMBER, e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

REFERENCE DESIGNATIONS

A1	A5
CR10-11 K3,4,6,9-11 Q7,8 R32,33,38-41, 43-67 S2 TP3,4,6,8,9 U3,4,6 VR5-8	XA1

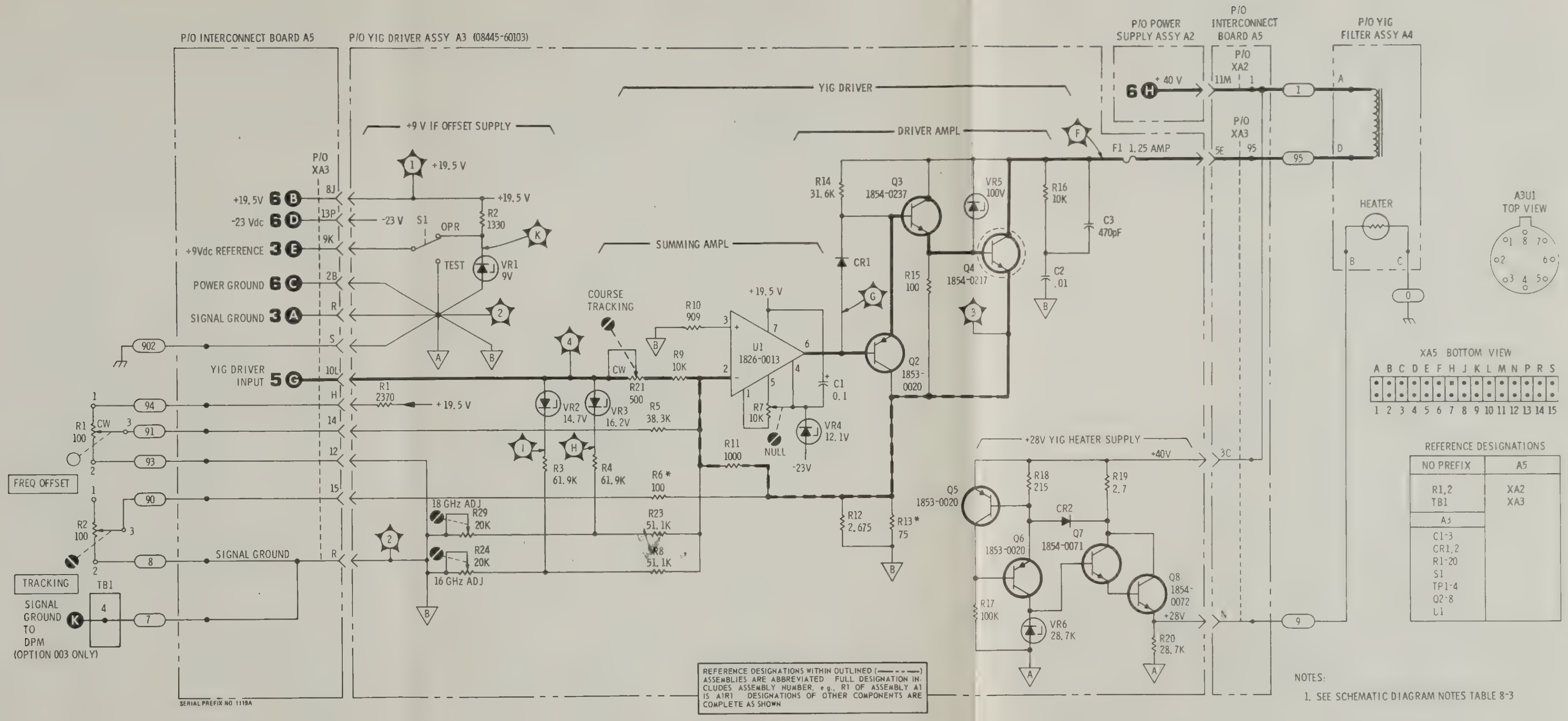
NOTES:
1. SEE SCHEMATIC DIAGRAM NOTES, TABLE 8-3.

A POWER GROUND
B SIGNAL GROUND

3A
A1

Figure 8-7. DPM Predriver Schematic Diagram

P/O A3 YIG Driver Assembly
SERVICE SHEET 4

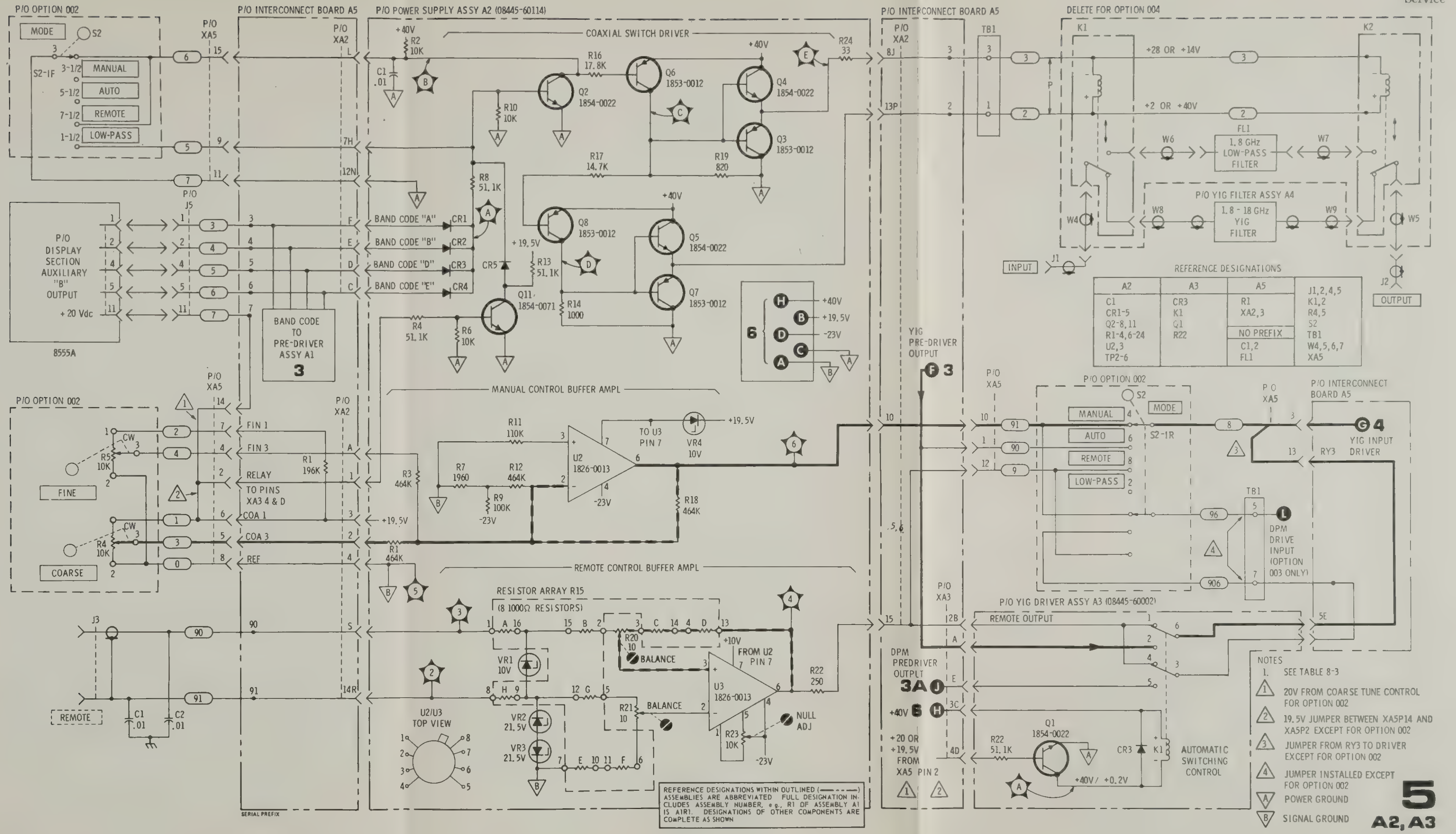


4
A3, A4

Figure 8-8. Yig Driver Schematic Diagram

P/O A2 Power Supply Assembly
Switching, Manual and Remote Control
A4 YIG Filter Assembly
A5 Interconnect Board
SERVICE SHEET 5

◀ P/O A3 YIG Driver Assembly
SERVICE SHEET 4



REFERENCE DESIGNATIONS WITHIN OUTLINED (——-·-·——) ASSEMBLIES ARE ABBREVIATED FULL DESIGNATION INCLUDES ASSEMBLY NUMBER, e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

REFERENCE DESIGNATIONS

A2	A3	A5	
C1 CR1-5 Q2-8,11 R1-4,6-24 U2,3 TP2-6	CR3 K1 Q1 R22	R1 XA2,3 NO PREFIX C1,2 FL1	J1,2,4,5 K1,2 R4,5 S2 TB1 W4,5,6,7 XA5

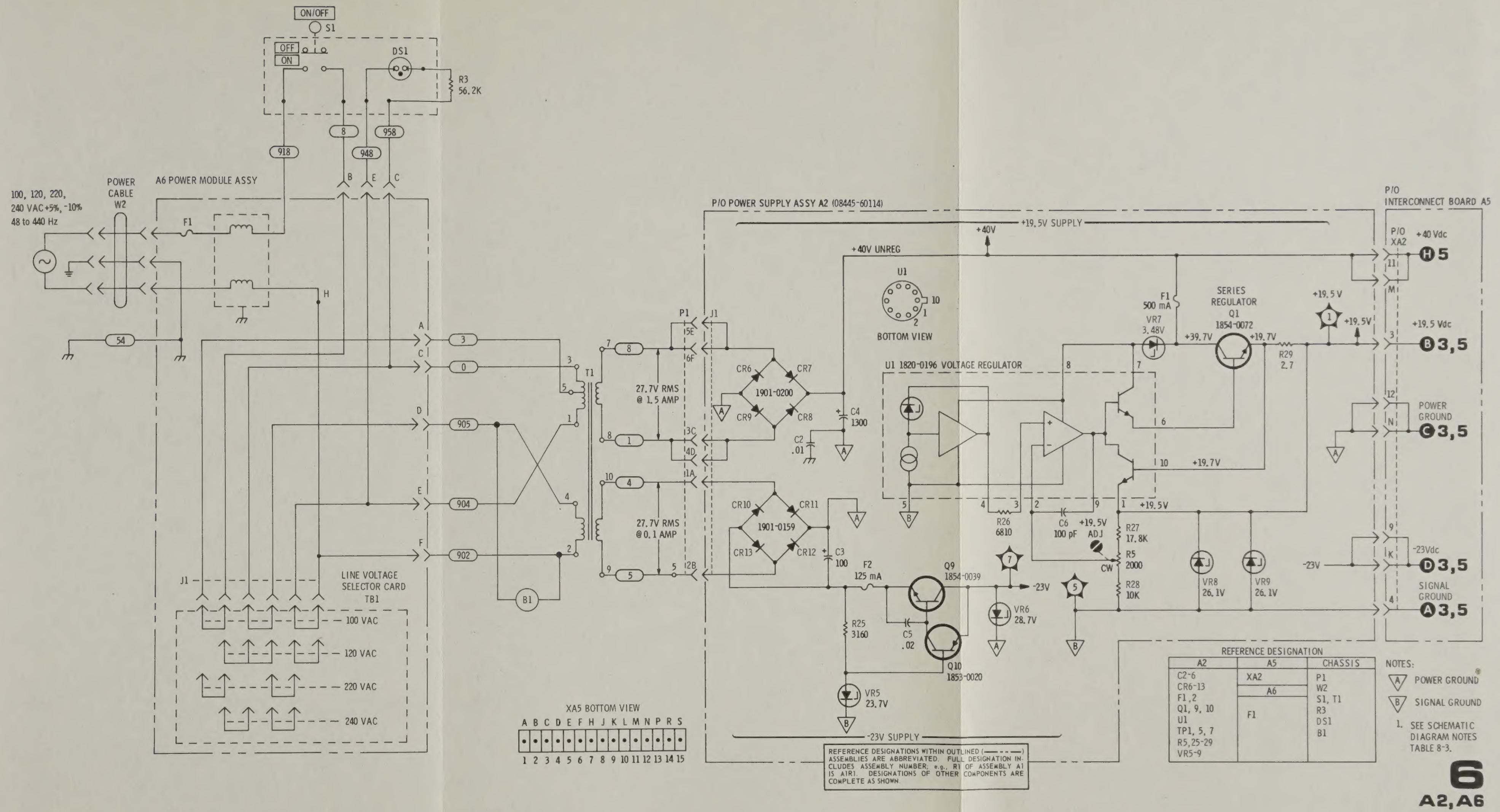
NOTES
1. SEE TABLE 8-3
1. 20V FROM COARSE TUNE CONTROL FOR OPTION 002
2. 19.5V JUMPER BETWEEN XA5P14 AND XA5P2 EXCEPT FOR OPTION 002
3. JUMPER FROM RY3 TO DRIVER EXCEPT FOR OPTION 002
4. JUMPER INSTALLED EXCEPT FOR OPTION 002
A POWER GROUND
B SIGNAL GROUND

5
A2, A3

Figure 8-9. Remote and Manual Control Amplifiers/ Switching Circuits Schematic Diagram

P/O A2 Power Supply Assembly
A6 Power Module Assembly
SERVICE SHEET 6

P/O A2 Power Supply Assembly
Switching, Manual and Remote Control
A4 YIG Filter Assembly
A5 Interconnect Board
◀ SERVICE SHEET 5



REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.

REFERENCE DESIGNATION

A2	A5	CHASSIS
C2-6 CR6-13 F1,2 Q1, 9, 10 U1 TP1, 5, 7 R5,25-29 VR5-9	XA2	P1 W2 S1, T1 R3 DS1 B1
	A6	
	F1	

NOTES:

Ⓐ POWER GROUND

Ⓑ SIGNAL GROUND

1. SEE SCHEMATIC DIAGRAM NOTES TABLE 8-3.

Figure 8-10. Power Supply Schematic Diagram

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TWX: 710-326-6904

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